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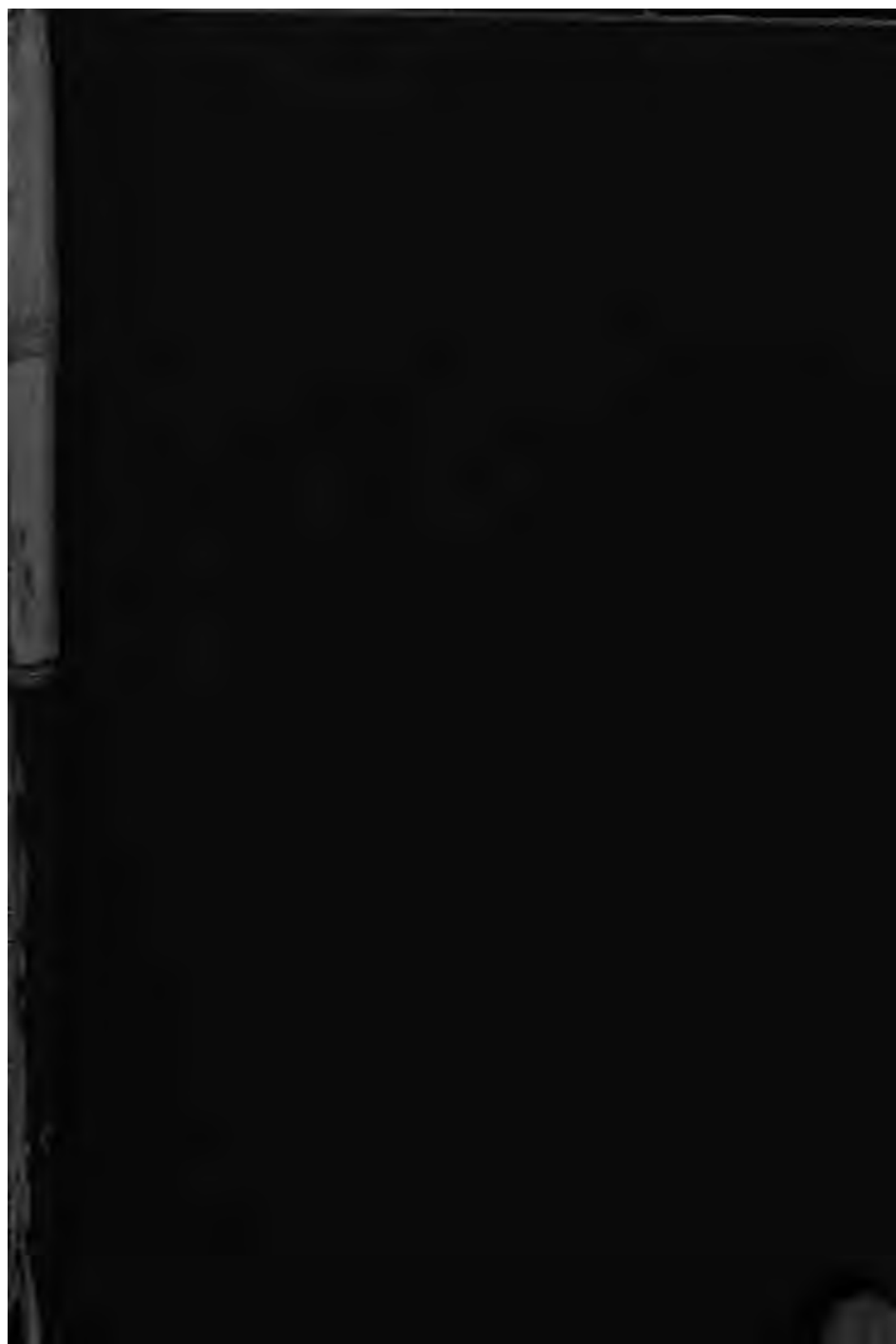
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HANDBOOK
OF
GEOLOGICAL TERMS

“ In this, as in every other field of labour, no man can put aside the curse pronounced on him—that by the sweat of his brow he shall reap his harvest. Before he can reach that elevation from whence he may look down upon and comprehend the mysteries of the natural world, his way is steep and toilsome, and he must read the records of creation in a strange, and to many minds a repulsive language, which, rejecting both the senses and the imagination, speaks only to the understanding. But when this language is once learned, it becomes a mighty instrument of thought, teaching us to link together the phenomena of past and future times ; and gives the mind a domination over many parts of the material world, by teaching it to comprehend the laws by which the actions of material things are governed.”—*SEDGWICK'S Cambridge Discourse.*

Crane C. Pursey

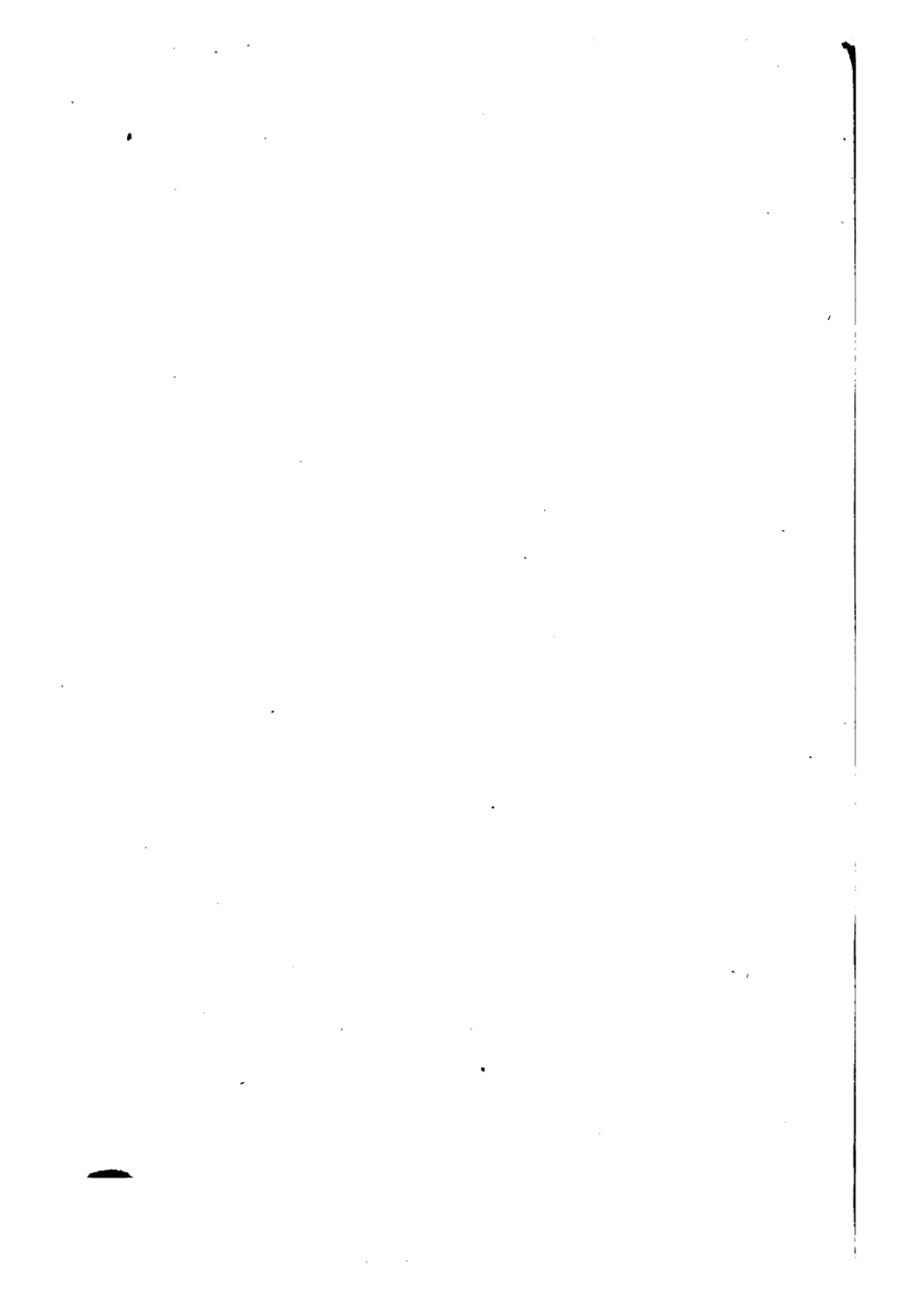
HANDBOOK
OF
GEOLOGICAL TERMS
GEOLOGY
AND
PHYSICAL GEOGRAPHY

BY
DAVID PAGE, F.R.S.E. F.G.S.

AUTHOR OF 'TEXT-BOOKS OF GEOLOGY AND PHYSICAL GEOGRAPHY,' 'PAST AND PRESENT
LIFE OF THE GLOBE,' 'PHILOSOPHY OF GEOLOGY,' ETC.

SECOND EDITION, REVISED AND ENLARGED

WILLIAM BLACKWOOD AND SONS
EDINBURGH AND LONDON
MDCCCLXV



PREFACE

SHOULD it be asked why I publish this volume, I answer, along with many others, Because I believe such a Handbook to be greatly needed ; and under this conviction have done my best, within moderate limits, to render it useful. Go where you will—to the popular platform, the public lecture-room, or the private parlour—and you hear immense interest professed in the science of Geology ; but the profession, for the most part, accompanied by the regret that its “hard words and forbidding technicalities” should render it so difficult of acquirement. Now, while deprecating, in the strongest manner, the introduction of unnecessary terms, it is quite evident that every science must have its own technicalities and modes of expression : new objects require new names, and new facts new phrases to express their relations. There is no avoiding this necessity in any progressive branch of human knowledge, and the only thing that can be done to lessen the difficulty—next to the rigid exclusion of whatever seems superfluous—is to explain these terms in brief and simple language. This I have endeavoured to do, chiefly with a view to the requirements of the general reader, at the

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PREFACE.

same time appending such details as might render the volume an acceptable Handbook of Reference to the student and professed Geologist. Thus the ordinary reader will generally find the information he requires in the first and second sentences of a definition ; what follows is addressed more especially to the professional inquirer—to the student, miner, engineer, architect, agriculturist, and others, who may have occasion to deal with geological facts, and yet who might not be inclined to turn up half-a-dozen volumes, or go through a course of geological readings, for an explanation of the term in question.

Such is the aim and object of this "Handbook of Geological Terms." I lay claim to little more than the arrangement of the matter, which has been gleaned and sifted from many sources—care having always been taken to present the science in its newest aspects, and to express its facts in the clearest and simplest language. Sensible of many imperfections, I would respectfully solicit corrections from those who may generally approve of the work, in order that any subsequent edition may be rendered more worthy of the Science whose truths we are labouring to establish—a science which, whether intellectually or economically considered, stands second to none on the roll of human acquirements.

D. P.

GILMORE PLACE, EDINBURGH,
August 1859.

SECOND EDITION

IN preparing this edition, alterations rendered necessary by the progress of the science have been freely made, and the more important terms introduced by recent discovery extensively inserted. To have inserted all or nearly all would have increased the volume beyond the limits of a "Hand-book," and merely cumbered its pages with names, a great proportion of which are avowedly provisional, and many even of doubtful validity. As a new feature, the leading technicalities of Physical Geography have been given along with those of Geology—the Author believing that the two sciences are inseparably associated, and that the readiest way to a comprehension of the world's past is through the study of its existing phenomena.

August 1865.

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NOTE.—“It is, indeed,” says Agassiz, in his recent ‘*Essay on Classification*,’ “a very unfortunate tendency, which prevails now almost universally among naturalists, with reference to all kinds of groups, of whatever value they may be, from the branches down to the species, to separate at once from one another any types which exhibit marked differences, without even inquiring first whether these differences are of a kind that justifies such separations. In our systems, the quantitative element of differentiation prevails too exclusively over the qualitative. If such distinctions are introduced under well-sounding names, they are almost certain to be adopted; as if science gained anything by concealing a difficulty under a Greek or Latin name, or was advanced by the additional burden of a new nomenclature. Another objectionable practice, prevailing quite as extensively also, consists in the change of names, or the modification of the extent and meaning of old ones, without the addition of new information or of new views. If this practice is not abandoned, it will necessarily end in making Natural History a mere matter of nomenclature, instead of fostering its higher philosophical character.” Influenced by this opinion, I have adopted in the following tabulations such arrangements of the Mineral, Vegetable, and Animal kingdoms as have been sanctioned by our leading naturalists—which appear to be most intelligible to the general reader—and on which, indeed, the greater portion of the nomenclature of Geology and Palaeontology has been founded.

CHEMICAL SCHEME,

Exhibiting the so-called "Elementary Substances" in alphabetical order, with their symbols and chemical equivalents—Hydrogen being taken as 1.

<i>Elements.</i>	<i>Symbols.</i>	<i>Equivalents.</i>
Aluminium	Al	13.69
Antimony (<i>Stibium</i>)	Sb	129.03
Arsenic	As	75.
Barium	Ba	68.64
Bismuth	Bi	70.95
Boron	B	10.90
Bromine	Br	78.26
Cadmium	Cd	55.74
Cæsium	Cs	133.
Calcium	Ca	20.
Carbon	C	6.
Cerium	Ce	46.
Chlorine	Cl	35.50
Chromium	Cr	28.15
Cobalt	Co	29.52
Copper (<i>Cuprum</i>)	Cu	31.66
Didymium	—	48.
Erbium	—	—
Fluorine	F	18.70
Glucinium or Beryllium	Gl	26.50
Gold (<i>Aurum</i>)	Au	98.33
Hydrogen	H	1.
Illmenium	Il	—
Iodine	I	126.36
Iridium	Ir	98.68
Iron (<i>Ferrum</i>)	Fe	28.
Lanthanum	La	48.
Lead (<i>Plumbum</i>)	Pb	103.56
Lithium	Li	6.43
Magnesium	Mg	12.67
Manganese	Mn	27.67
Mercury (<i>Hydrargyrum</i>)	Hg	100.07
Molybdenum	Mo	47.88
Nickel	Ni	29.57
Niobium	Nb	—
Nitrogen	N	14.
Norium	No	—

CHEMICAL SCHEME.

<i>Elements.</i>	<i>Symbols.</i>	<i>Equivalents.</i>
Osmium	Os	95.56
Oxygen	O	8.
Palladium	Pd	53.27
Pelopium	Pe	—
Phosphorus	P	32.
Platinum	Pt	98.68
Potassium (<i>Kalium</i>)	K	39.
Rhodium	R	52.11
Ruthenium	Ru	52.11
Selenium	Se	39.57
Silicium, Silicon	Si	21.35
Silver (<i>Argentum</i>).....	Ag	108.
Sodium (<i>Natrium</i>)	Na	22.97
Strontium	Sr	43.84
Sulphur	S	16.
Tantalum or Columbium ...	Ta	92.30
Tellurium	Te	66.14
Terbium	—	—
Thallium.....	Tl	204.
Thorium.....	Th	59.59
Tin (<i>Stannum</i>)	Sn	58.82
Titanium	Ti	24.29
Tungsten or Wolfram	W	94.64
Uranium.....	U	60.
Vanadium	V	68.55
Yttrium	Y	32.20
Zinc.....	Zn	32.52
Zirconium	Zr	33.62

Of the preceding elementary or ultimate substances only a few enter largely into the composition of the earth's crust; and of the others many are extremely rare, or only evolved from their natural unions by chemical analysis. In the following list the most important (geologically speaking) are printed in capitals, their characters being given as under the ordinary pressure and temperature of the atmosphere:—

Gases—HYDROGEN, OXYGEN, nitrogen, CHLORINE, and FLUORINE.

Non-Metallic Liquids and Solids—Bromine, iodine, SULPHUR, PHOSPHORUS, selenium, CARBON, boron, SILICON.

Metals being the basis of the Earths and Alkalies—POTASSIUM, SODIUM, lithium; barium, strontium, CALCIUM; MAGNESIUM, ALUMINIUM, thorium, glucinium, zirconium, yttrium.

The Metals—MANGANESE, ZINC, IRON, TIN, cadmium, COBALT, NICKEL; ARSENIC, CHROMIUM, vanadium, molybdenum, tungsten, columbium, ANTIMONY, uranium, cerium, BISMUTH, titanium, tellurium, COPPER, LEAD; MERCURY, SILVER, GOLD, PLATINUM, palladium, rhodium, osmium, iridium, ruthenium; (and the following, of which little is yet determined), cæsium, erbium, terbium, didymium, lanthanum, niobium, norium, ilmenium, pelopium, thallium.

MINERAL SCHEME,

Exhibiting the simple minerals, or constituents of rock-masses, as arranged by Professor Weiss, of Berlin, into Orders and Families.

I. ORDER—OXIDISED STONES.

- Families* :—1. QUARTZ. 7. MICA.
2. FELSPAR. 8. HORNBLÉNDE.
3. SCAPOLITE. 9. CLAYS.
4. HALOID STONES. 10. GARNET.
5. LEUCITE. 11. GEMS.
6. ZEOLITES. 12. METALLIC STONES.

II. ORDER—SALINE STONES.

- Families* :—1. CALC-SPAR. 4. GYPSUM.
2. FLUOR-SPAR. 5. ROCK-SALT.
3. HEAVY-SPAR.

III. ORDER—SALINE ORES.

- Families* :—1. SPARRY IRON ORES. 3. LEAD SALTS.
2. COPPER SALTS.

IV. ORDER—OXIDISED ORES.

- Families* :—1. IRON ORES. 4. RED COPPER ORES.
2. TINSTONE. 5. WHITE ANTIMONY ORES.
3. MANGANESE ORES.

V. ORDER—NATIVE METALS.

Form only one Family.

VI. ORDER—SULPHURETTED METALS.

- Families* :—1. IRON PYRITES. 4. GREY COPPER ORE.
2. GALENA. 5. BLENDE.
3. GREY ANTIMONY ORE. 6. RUBY BLENDE.

VII. ORDER—INFLAMMABLES.

- Families* :—1. SULPHUR. 4. MINERAL RESINS.
2. DIAMOND. 5. COMBUSTIBLE SALTS.
3. COAL.

MINERAL SCHEME.

The following list contains the so-called SPECIES usually arranged under the respective families—the more abundant and better known being marked in *Italics*.

ORDER—OXIDISED STONES.

1. QUARTZ FAMILY (2 Species).—*Quartz*, *Opal*.
2. FELSPAR FAMILY (14 Species).—*Orthoclase*, *Ryacolite*, *Albite*, *Andesin*, *Saccharite*, *Labradorite*, *Couzeranite*, *Anorthite*, *Oligoclase*, *Petalite*, *Spodumene*, *Kastor*, *Pollux*, *Amorphous Felspar*.
3. SCAPOLITE FAMILY (13 Species).—*Scapolite*, *Nuttallite*, *Barsowite*, *Ottrelite*, *Palagonite*, *Dipyr*, *Nepheline*, *Davyne*, *Gehlenite*, *Humboldtillite*, *Prehnite*, *Zeuxite*, *Nephrite*.
4. HALOID STONES (9 Species).—*Lazulite*, *Calaite*, *Wavellite*, *Wagnerite*, *Amblygonite*, *Alunite*, *Aluminite*, *Pissophane*, *Latrobeite*.
5. LEUCITE (8 Species).—*Leucite*, *Porcelain spar*, *Sodalite*, *Hauyne*, *Nosean*, *Ittnerite*, *Lapis Lazuli*, *Eudialite*.
6. ZEOLITES (22 Species).—*Analcime*, *Natrolite*, *Scolezite*, *Damourite*, *Thomsonite*, *Stilbite*, *Aedelforsite*, *Heulandite*, *Brewsterite*, *Epistilbite*, *Apophyllite*, *Okenite*, *Pectolite*, *Chabasite*, *Faujasite*, *Harmotome*, *Philipsite*, *Zeagonite*, *Laumonite*, *Leonhardite*, *Glottalite*, *Edingtonite*.
7. MICA FAMILY (31 Species).—*Potash Mica*, *Lithia Mica*, *Magnesia Mica*, *Lepidomelane*, *Chloritoid*, *Chlorite*, *Ripidolite*, *Talc*, *Schillerspar*, *Antigorite*, *Hydropite*, *Serpentine*, *Picrosmine*, *Villarsite*, *Spadaite*, *Gymnite*, *Chonikrite*, *Pyrosklerite*, *Kammererite*, *Pyrosmalite*, *Cronstedtite*, *Stilpnomelan*, *Bruceite*, *Hydromagnesite*, *Nemalite*, *Seybertite*, *Margarite*, *Pyrophyllite*, *Anauxite*, *Pholerite*, *Rosellan*.
8. HORNBLLENDE FAMILY (19 Species).—*Hornblende*, *Augite*, *Hypersthene*, *Bronzite*, *Diallage*, *Rhodinite*, *Tephroite*, *Troostite*, *Wollastonite*, *Achmite*, *Sordawalite*, *Krokydolite*, *Pyralloite*, *Pyrgillite*, *Karpolite*, *Babingtonite*, *Isopyre*, *Polyite*, *Tachylite*.
9. CLAYS (24 Species).—*Kaolin*, *Clay*, *Rock-soap*, *Plinthite*, *Green-Earth*, *Yellow-Earth*, *Halloysite*, *Fullers'-Earth*, *Allophane*, *Schröterite*, *Challilite*, *Bole*, *Teratolite*, *Kollyrite*, *Lithomarge*, *Miloschin*, *Kerolite*, *Agalmatolite*, *Soapstone*, *Pipestone*, *Meerschauum*, *Pimelite*, *Dermatin*, *Retinalite*.
10. GARNET FAMILY (15 Species).—*Garnet*, *Pyrope*, *Helvine*, *Idocrase*, *Epidote*, *Axinite*, *Cyanite*, *Sillimanite*, *Bamlite*, *Andalusite*, *Staurolite*, *Diaspore*, *Hydrargillite*, *Periclaase*, *Glaucophane*.
11. GEMS (16 Species).—*Zircon*, *Malacon*, *Spinel*, *Automalite*, *Corundum*, *Crysoberyl*, *Topaz*, *Pycnite*, *Leucophane*, *Eucrase*, *Emerald*, *Phenakite*, *Iolite*, *Tourmaline*, *Crysolite*, *Chondrodite*.
12. METALLIC STONES (22 Species).—*Lisovite*, *Hisingerite*, *Anthosiderite*, *Nonttronite*, *Pinguite*, *Chloropal*, *Chlorophane*, *Thorite*, *Eulytine*, *Gadolinite*, *Allanite*, *Tschewkinite*, *Cerite*, *Pyrochlore*, *Keilhauite*, *Polymignite*, *Polycrase*, *Peroskite*, *Aeschynite*, *Mengite*, *Monazite*, *Samarskite*.

MINERAL SCHEME.

ORDER—SALINE STONES.

1. **CALC-SPAR FAMILY** (6 Species).—*Calc-spar*, *Dolomite*, *Brunnerite*, *Magnesite*, *Mesitine Spar*, *Arragonite*.
2. **FLUOR-SPAR FAMILY** (14 Species).—*Fluor-spar*, *Yttrocerite*, *Fluocerite*, *Fluocerine*, *Cryolite*, *Chryolite*, *Hopeite*, *Apatite*, *Herderite*, *Childrenite*, *Xenotime*, *Boracite*, *Hydroboracite*, *Datholite*.
3. **HEAVY-SPAR FAMILY** (7 Species).—*Barytes*, *Dreelite*, *Witherite*, *Alstonite*, *Baryto-Calcite*, *Celestine*, *Strontianite*.
4. **GYP SUM FAMILY** (7 Species).—*Gypsum*, *Anhydrite*, *Polyhalite*, *Glauberite*, *Pharmacolite*, *Haidingerite*, *Berzelite*.
5. **ROCK-SALT FAMILY** (28 Species).—*Rock-Salt*, *Alum*, *Alunogene*, *Glauber Salt*, *Melanterite*, *Botryogene*, *Copiapite*, *Coquimbite*, *Tectizite*, *Cyanose*, *Goslarite*, *Bieberite*, *Johannite*, *Natron*, *Thermonatrite*, *Trona*, *Gaylussite*, *Borax*, *Sassoline*, *Nitre*, *Nitratine*, *Nitrocalcite*, *Nitro-Magnesite*, *Sal-Ammoniac*, *Mascagnine*, *Arcanite*, *Thenardite*, *Epsomite*.

ORDER—SALINE ORES.

1. **SPARRY IRON ORES** (17 Species).—*Siderite*, *Ankerite*, *Diallogite*, *Manganocalcite*, *Lanthanite*, *Parisite*, *Calamine*, *Galmei*, *Williamite*, *Triplite*, *Zwieselite*, *Triphyline*, *Hureaulite*, *Heterozite*, *Alluaudite*, *Pitticite*, *Diadochite*.
2. **COPPER SALTS** (32 Species).—*Diopase*, *Chrysocolla*, *Azurite*, *Malachite*, *Aurichalcite*, *Chalcophyllite*, *Tirolite*, *Erinite*, *Liroconite*, *Olivenite*, *Euchroite*, *Klinoclase*, *Phosphorocalcite*, *Thrombolite*, *Libethenite*, *Tagilite*, *Ehlite*, *Atacamite*, *Volborthite*, *Arseniosiderite*, *Pharmakosiderite*, *Scorodite*, *Symplesite*, *Brochantite*, *Vivianite*, *Dufrenite*, *Uranite*, *Chalcolite*, *Erythrine*, *Nickeline*, *Langite*, *Lyellite*.
3. **LEAD SALTS** (27 Species).—*Cerussite*, *Anglesite*, *Leadhillite*, *Lanarkite*, *Caledonite*, *Linarite*, *Phosgenite*, *Mendipite*, *Cotunnite*, *Pyromorphite*, *Mimetesite*, *Bleinierite*, *Vanadinite*, *Wulfenite*, *Scheelinite*, *Plomb-gomme*, *Crocoisite*, *Melanochroite*, *Vauquelinite*, *Bismuthite*, *Kerate*, *Calomel*, *Iodite*, *Coccinite*, *Bromite*, *Romeite*, *Scheelite*.

ORDER—OXIDISED ORES.

1. **OXIDISED IRON ORES** (9 Species).—*Magnetite*, *Chromite*, *Franklinite*, *Haematite*, *Irite*, *Limonite*, *Gothite*, *Ilmenite*, *Iserine*.
2. **TIN ORE FAMILY** (13 Species).—*Cassiterite*, *Wolfram*, *Columbite*, *Tantalite*, *Yttrotantalite*, *Euxinite*, *Fergusonite*, *Sphene*, *Brookite*, *Rutile*, *Anatase*, *Pechurane*, *Plattnerite*.
3. **MANGANESE ORES** (20 Species).—*Pyrolusite*, *Polianite*, *Manganite*, *Hausmannite*, *Braunite*, *Psilomelane*, *Crednerite*, *Cupreous Manganese*, *Earthy Cobalt*, *Wad*; — (Ochres), *Cobalt O.*, *Molybdena O.*, *Bismuth O.*, *Antimony O.*, *Tungsten O.*, *Uranium O.*, *Minium*, *Lead O.*, *Chrome O.*, *Tellurite*.
4. **RED COPPER ORES** (4 Species).—*Cuprite*, *Chalcotrichite*, *Tenorite*, *Zincite*.
5. **WHITE ANTIMONY ORES** (2 Species).—*Valentinite*, *Arsenite*.

MINERAL SCHEME.

ORDER—NATIVE METALS.

1. THE METALS (18 Species).—*Platinum, Palladium, Osmiumiridium, Iridium, Gold, Silver, Antimony-Silver, Mercury, Amalgam, Antimony, Arsenio-Antimony, Arsenic, Tellurium, Lead, Tin, Bismuth, Copper, Iron.*

ORDER—SULPHURETTED METALS.

1. PYRITES FAMILY (21 Species).—*Pyrite, Marcasite, Pyrrhotine, Leucopyrite, Mispickel, Cobaltine, Smaltine, Modumite, Linneite, Grünauite, Gersdorffite, Ullmannite, Breithauptite, Plakodine, Nickeline, Rammeisbergite, Millerite, Chalcopyrite, Bornite, Domeykite, Arseniate of Manganese.*
2. LEAD GLANCE FAMILY (17 Species).—*Galena, Cuproplumbite, Clausenthalite, Selencopper Lead, Onofrite, Naumannite, Argentite, Stromeyerite, Redruthite, Kupferinding, Eukairite, Berzeline, Nagyagite, Altaite, Hessite, Tetradyomite, Molybdenite.*
3. GREY ANTIMONY ORES (16 Species).—*Stibine, Jamesonite, Zinckenite, Plagionite, Boulangerite, Geokronite, Steinmannite, Plumosite, Dufrenoy'site, Wolfsbergite, Kermes, Berthierite, Bismuthine, Aciculite, Kobellite, Sylvanite.*
4. GREY COPPER ORES (11 Species).—*Fahlore, Tennantite, Bournonite, Wülfchite, Freieslebenite, Stephanite, Polybasite, Sternbergite, Stannine, Cupreous Bismuth, Bismuthic Silver.*
5. BLENDES (5 Species).—*Blende, Woltzine, Alabandine, Hauerite, Greenockite.*
6. RUBY BLENDES (6 Species).—*Pyrargyrite, Miargyrite, Xanthokon, Cinnabar, Realgar, Orpiment.*

ORDER—THE INFLAMMABLES.

1. SULPHUR FAMILY.—*Sulphur, Selen-Sulphur.*
2. DIAMOND.—*Diamond.*
3. COALS (5 Species).—*Graphite, Anthracite, Common Coal, Lignite, Peat.*
4. MINERAL RESINS (21 Species).—*Bitumen, Elaterite, Asphaltum, Piasite, Ixolyte, Amber, Retinite, Walchowite, Copaline, Berengelite, Guyaquillite, Hartine, Middletonite, Ozokerite, Hatchettine, Fichtelite, Hartite, Könlite, Scheererite, Idrialite, Scleretinite.*
5. INFLAMMABLE SALTS (2 Species).—*Mellite, Oxalate.*

VEGETABLE SCHEME.

The Vegetable Kingdom may be arranged into two grand divisions—the CELLULAR and VASCULAR; and these, according to their modes of growth and reproduction, into the following groups and classes:—

- I. CELLULAR—Without regular vessels, but composed of fibres which sometimes cross and interlace each other. The *Conferæ* (green scum-like aquatic growths), the *Lichens* (which incrust stones and decaying trees), the *Fungi* (or mushroom tribe), and the *Algæ* (or sea-weeds), belong to this division. In some of these families there are no apparent seed-organs. From their mode of growth—viz., sprout-like increase of the same organ—they are known as THALLOGENS or AMPHIGENS.
- II. VASCULAR—With vessels which form organs of nutrition and reproduction. According to the arrangement of these organs, vascular plants have been grouped into two great divisions—CRYPTOGAMIC (no visible seed-organs), and PHANEROGAMIC (apparent flowers or seed-organs). These have been further subdivided into the following classes:—
 1. CRYPTOGAMS—Without perfect flowers, and with no visible seed-organs. To this class belong the *mosses*, *equisetums*, *ferns*, and *lycopodiums*. It embraces many fossil forms allied to these families. From their mode of growth—viz., increase at the top or growing point only—they are known as ACROGENS.
 2. PHANEROGAMIC MONOCOTYLEDONS — Flowering plants with one cotyledon or seed-lobe. This class comprises the *water-lilies*, *lilies*, *aloes*, *rushes*, *grasses*, *canes*, and *palms*. In allusion to their growth, by increase within, they are termed ENDOGENS.
 3. PHANEROGAMIC GYMNOSPERMS—This class, as the name indicates, is furnished with flowers, but has naked seeds. It embraces the *cycadæ* or pine-apple tribe, and the *conifera* or firs. In allusion to their naked seeds, these plants are also known as GYMNOGENS.
 4. PHANEROGAMIC DICOTYLEDONS — Flowering plants with two cotyledons or seed-lobes. This class embraces all forest trees and shrubs—the *compositæ*, *leguminosæ*, *umbellifera*, *crucifera*, and other similar orders. None of the other families of plants have the true woody structure, except the *conifera* or firs, which seem to hold an intermediate place between monocotyledons and dicotyledons; but the wood of these is readily distinguished from true dicotyledonous wood. From their mode of growth, increase by external rings or layers, they are termed EXOGENS.

VEGETABLE SCHEME.

Or, founding, *first*, on the different modes of reproduction ; *second*, on the aspect of the reproducing organs ; *thirdly*, on the primary development ; and *fourthly*, on the ultimate development of the plant, the botanist arrives at a scheme of classification which may be tabulated as follows :—

SPERMOCARPS	ANGIOSPERMS	EXOGENS.....	DICOTYLEDONS	Trees, Shrubs, Herbs.
		ENDOGENS	MONOCOTYLEDONS.....	Grasses, Sedges, Palms.
	GYMNOSPERMS	GYMNOSPERMS...GYMNOGENS.....POLYCOTYLEDONS		
		Cycads and Conifers.		
SPOROCARPS...	ANGIOSPORES ... ACROGENS....	{		
		SPOROGAMS.....Clubmosses, Lycopoda.		
		THALLOGAMS		
	GYMNOSPORES...AMPHIGENS...	{		
		AXOGAMS		
		Mosses and Liverworts.		
	GYMNOSPORES...AMPHIGENS...	{		
		HYDROPHYTES		
		Algae and Confeŕvæ.		
		{		
		AËROPHYTES		
		Lichens.		
		{		
		HYSTEROPHYTES		
		Fungi or Mushrooms.		

Subdividing still further, according to their most marked characteristics, whether external or internal, the Botanist arranges all the forms of Vegetable Life into some 60 or 70 orders, upwards of 300 genera, and nearly 100,000 species. As most of these distinctions, however, are founded on the form and connection of the flower, fruit, and leaf—organs which rarely or never occur in connection in a fossil state—the Palæontologist is guided in the main by the great structural distinctions above adverted to, and not unfrequently by the simple but unsatisfactory test of “general resemblance.”

VEGETABLE SCHEME.

Or, following the arrangement adopted by Professor Lindley, we have the subjoined classes, sections, and alliances:—

- Class I. THALLOGENS**—Asexual or Flowerless plants, without proper stems or leaves. These include three alliances—*Algales*, *Fungales*, and *Lichenales*.
- Class II. ACROGENS**—Asexual or Flowerless plants with stems and leaves. Includes three alliances—*Muscales*, *Lycopodales*, and *Filicales*.
- Class III. RHIZOGENS**—Sexual or Flowering plants with Acotyledonous embryos and fructification, springing from a thallus—as in *Rafflesiaceae*.
- Class IV. ENDOGENS**—Monocotyledonous Flowering plants with Endogenous stems, parallel venation, and ternary symmetry. This class is subdivided into four sections:—
1. Plants with glumaceous flowers formed by imbricated bracts.
 2. Petaloid unisexual flowers.
 3. Petaloid hermaphrodite flowers adherent to the ovary.
 4. Petaloid hermaphrodite flowers free from the ovary.
- Under these sections are included 11 alliances, such as *Glumales*, *Arales*, *Palmales*, *Narcissales*, *Orchidales*, *Juncales*, and *Liliales*.
- Class V. DICTYOGENS**—Monocotyledonous plants with reticulated venation, including such orders as *Discoreaceae*, *Smilacaceae*, and *Trilliaceae*.
- Class VI. GYMNOGENS**—Polycotyledonous Exogens with naked seeds, as *Coniferae* and *Cycadaceae*.
- Class VII. EXOGENS**—Dicotyledonous plants with seeds in a seed-vessel. Under this head are arranged the following sub-classes:—
- Sub-class 1. **DICLINOUS EXOGENS**, or Dicotyledons with unisexual flowers, and no tendency to form hermaphrodite flowers; includes 8 alliances, such as *Amentales*, *Urticales*, *Euphorbiales*, *Menispermals*, *Cucurbitales*.
- Sub-class 2. **HYPOGYNOUS EXOGENS**, or Dicotyledons with hermaphrodite or polygamous flowers, and stamens entirely free from the calyx and corolla; including 14 alliances, such as *Violales*, *Cistales*, *Malvales*, *Nymphaeales*, *Ranales*, *Berberales*, *Ericales*, *Rutales*, *Geraniales*, *Silinales*, *Chenopodales*, and *Piperals*.
- Sub-class 3. **PERIGYNOUS EXOGENS**, or Dicotyledons with hermaphrodite or polygamous flowers, the stamens growing to the side of either the calyx or corolla, ovary superior, or nearly so; includes 10 alliances, such as *Daphnals*, *Rosales*, *Saxifragales*, *Gentianals*, *Solanales*, *Echiales*, and *Bignoniales*.
- Sub-class 4. **EPIGYNOUS EXOGENS**, or Dicotyledons with hermaphrodite or polygamous flowers, the stamens growing to the side of either the calyx or corolla, ovary inferior or nearly so. This includes 7 alliances—*Campanales*, *Myrtals*, *Cactals*, *Grossals*, *Cinchonals*, *Umbellals*, and *Asarals*.

VEGETABLE SCHEME.

COMPARATIVE ARRANGEMENTS.

The following tabulation exhibits, comparatively, the systematic schemes of Brongniart, Göppert, Bronn, and Lindley—names the most intimately associated with the exposition and advancement of Palaeophytology, or the science of Fossil Botany:—

	BRONGNIART.	GÖPPERT; BRONN.	UNGER.	LINDLEY.
CRYPTOGAMÆ	{	Amphigenæ .....Pl. { Cellulares }	Thallophyta.....	Thallogena.
		Fungina. <i>Algae.</i>		
		Acrogens .....Pl. { Vasculares }		
		Acrogens .....Pl. { Cryptogamæ }		
		Filicina. <i>Characeæ. Lycopodiaceæ. Equisetaceæ.</i>		
PHANEROGAMÆ	{	Monocotyledones.....Phanerogamæ	Amphibrya.....	Endogena.
		<i>Cyperaceæ. Typhaceæ. Pandanaceæ. Palmae.</i>		
		Gymnosperme...Gymnosperme		
		<i>Gulamiteæ. Asterophyllite. Sigillaria. Cycadeæ. Næggerathia. Conifera.</i>		
		1. Apetalæ { Monochlamideæ.....		
		2. Gamopetalæ { Corollifloræ.....		
		3. Dialypetalæ { Choristopetalæ		
		..... { Angiosperme.....	
		..... { Apetalæ { Acumbrbryæ }	
		..... { Gamopetalæ { Exogena.	
		..... { Dialypetalæ { Dialypetalæ	
		(1.) <i>Betulina. Ceratophylleæ. Proteaceæ.</i> (2.) <i>Syraciflueæ.</i> (3.) <i>Haloragceæ.</i>		
		<i>Cucurbitaceæ. Leguminosæ. Sapindaceæ. Malvaceæ. Rhamneæ.</i>		

DIATOMACEÆ.

Of these minute vegetable organisms, the following genera and species are those usually given as occurring most abundantly in the diatomaceous or microphytal earths that have been submitted to the microscope. The shields or cases of the Diatoms are siliceous; hence their beautiful and almost perfect preservation. The Desmidiæ or Desmids, also microscopic plant-growths consisting of one or only a few cells, are found in flint and hornstone, but they secrete little or no silica; hence their less frequent occurrence in a fossil state.

Actinocyclus.	Epithemia granulata.
— bioclonarius.	— Hyndmanii.
Actinoptychus.	— ocellata.
— biternarius.	— proboscidea.
— senarius.	— turgida.
Amphora.	— zebra.
— elliptica.	Eunotia.
— ovalis.	— gibba.
Bacillaria.	— granulata.
— paradoxa.	— levis.
Campylodiscus.	— longicornis.
— clypeus.	— monodon.
— noricus.	— tridentula.
Chætotyphla.	— zebrina.
— pyritæ.	Fragilaria.
Cocconeis.	— pinnata.
— pediculus.	— rhabdosoma.
Cocconema.	— striolata.
— cistula.	— virescens.
— cornutum.	Gallionella.
— cymbiforme.	— granulata.
— gracile.	— decussata.
— lanceolata.	— distans.
Coscinodiscus.	— procera.
— apiculatur.	— sulcata.
— gigas.	Gomphonema.
Cyclotella.	— acuminatus.
— minutula.	— constrictus.
— operculata.	— geminatum.
Cymbella.	— gracile.
— cuspidata.	— minutum.
— Ehrenbergii.	— pohlseforme.
— Helvetica.	Grammatophora.
— maculata.	— oceanica.
Dictyocha.	— parallela.
— crux.	Himantidium.
Epithemia.	— arcus.
— gibba.	— pectinale.

VEGETABLE SCHEME.

Meloscira.	Navicula viridis.
— arenaria.	Peridinium.
— Italica.	— pyrophorum.
— orichalcea.	Pinnularia.
— subflexilis.	— æqualis.
Navicula.	— perigrina.
— bacillum.	— tæniata.
— binodus.	— viridis.
— dicephala.	Pyxidicula.
— elliptica.	— prisca.
— forma.	Stauroneis.
— gracilis.	— amphicephala.
— inflata.	— cardinalis.
— lata.	— lanceolata.
— lineolata.	— Phœnicentron.
— major.	— platystoma.
— mesolepta.	— punctata.
— nobilis.	Surirella.
— nodosa.	— elliptica.
— oblonga.	— Solea.
— radiosa.	Synhedra.
— rhomboides.	— capitata.
— semen.	Tabellaria.
— sigma.	— fenestrata.
— sphærophora.	— ventricosa.
— tripunctata.	

ANIMAL SCHEME.

The following arrangement—being chiefly that of Cuvier, with such modifications as the progress of science demands—will render sufficiently apparent the main subdivisions and relations of the animal kingdom, and enable the reader to determine more readily the position of any fossil form in the scheme of vitality :—

VERTEBRATA,

Or animals with backbone and bony skeleton, and comprehending

MAMMALIA ; AVES ; REPTILIA ; and PISCES.

I. MAMMALIA or *Sucklers*, subdivided into Placental and Aplacental.

1. PLACENTAL, bringing forth mature young.

BIMANA (*Two-handed*)—Man.

QUADRUMANA (*Four-handed*)—Monkeys, Apes, Lemurs.

CHEIROPTERA (*Hand-winged*)—Bats, Vampire-bats, Fox-bats.

INSECTIVORA (*Insect-eaters*)—Mole, Shrew, Hedgehog, Banxring.

CARNIVORA (*Flesh-eaters*)—Dog, Wolf, Tiger, Lion, Badger, Bear.

PINNIPEDIA (*Fin-footed*)—Seals, Walrus.

RODENTIA (*Gnawers*)—Hare, Beaver, Rat, Squirrel, Porcupine.

EDENTATA (*Toothless*)—Ant-eater, Armadillo, Pangolin, Sloth.

RUMINANTIA (*Cud-chewers*)—Camel, Llama, Deer, Goat, Sheep, Ox.

SOLIDUNGULA (*Solid-hoofs*)—Horse, Ass, Zebra, Quagga.

PACHYDERMATA (*Thick-skins*)—Elephant, Hippopotamus, Rhinoceros, Pig.

CETACEA (*Whales*)—Whale, Porpoise, Dolphin, Lamantin.

2. APLACENTAL, bringing forth immature young.

MARSUPIALIA (*Pouched*)—Kangaroo, Opossum, Pouched Wolf, &c.

MONOTREMATA (*One-vented*)—Ornithorhynchus, Porcupine-ant-eaters.

II. AVES or BIRDS.

RAPTORES (*Seizers*)—Eagles, Falcons, Hawks, Owls, Vultures.

INSERORES (*Perchers*)—Jays, Crows, Finches, Sparrows, Thrushes.

SCANORES (*Climbers*)—Woodpeckers, Parrots, Parroquets, Cockatoos.

COLUMBÆ (*Pigeons*)—Common Dove, Turtle Dove, Ground Dove.

ANIMAL SCHEME.

RASORES (*Scrapers*)—Barnfowl, Partridge, Grouse, Pheasant.
CURSORES (*Runners*)—Ostrich, Emu, Rhea, Apteryx.
GRALLATORES (*Waders*)—Rails, Storks, Cranes, Herons, Bitterns.
NATATORES (*Swimmers*)—Divers, Gulls, Ducks, Pelicans.

III. REPTILIA, subdivided into Reptiles Proper and Batrachians.

1. REPTILES PROPER.

CHELONIA (*Tortoises*)—Turtles, Tortoises.
LORICATA (*Covered with Scutes*)—Crocodile, Gavial, Alligator.
SAURIA (*Lizards*)—Lizard, Iguana, Chameleon.
OPHIDIA (*Serpents*)—Vipers, Snakes, Boas, Pythons.

2. BATRACHIANS or FROGS.

ANOURA (*Tail-less*)—Toad, Frog, Tree-Frog.
URODELA (*Tailed*)—Siren, Triton, Salamander.
APODA (*Footless*)—Lepidosiren, Blindworm.

IV. PISCES or FISHES.

SELACHIA (*Cartilaginous*)—Chimæra, Sharks, Sawfish, Rays.
GANOIDEA (*Enamel-scales*)—Amia, Bony-pike, Sturgeon.
TELEOSTIA (*Perfect-bones*)—Eels, Salmon, Herring, Cod, Pike.
CYCLOSTOMATA (*Circle-mouths*)—Lamprey.
LEPTOCARDIA (*Slender-harts*)—Amphioxus.

· INVERTEBRATA,

Or animals void of backbone and bony skeleton, and comprehending

ARTICULATA, MOLLUSCA, RADIATA, and PROTOZOA.

I. ARTICULATA, subdivided into Articulates and Vermes.

1. ARTICULATA or Jointed Animals Proper.

INSECTA (*Insects*)—Beetles, Butterflies, Flies, Bees.
MYRIAPODA (*Many-feet*)—Scolopendra, Centipedes.
ARACHNIDA (*Spiders*)—Spiders, Scorpions, Mites.
CRUSTACEA (*Crust-clad*)—Crayfish, Crabs, Shrimps, Woodlice.
CIRRHOPODA (*Curl-feet*)—Acorn-shells, Barnacles.

2. VERMES or Worms Proper.

ANNELIDA (*Small rings*)—Lobworm, and almost all the marine worms.
ROTIFERA (*Wheel-bearers*)—Rotifers, Hydatina.
GEPHYRIA (*Intermediates—urchin-like*)—Sipunculus, Echinurus.
LUMBRICINA (*Earth-worms*)—Earth-worms, Nais.
HIRUDINEI (*Leeches*)—Leeches, Branchellion.
TURBELLARIA (*Turbellaries*)—Planaria, Ribbon-worms.
HELMINTHES (*Gut-worms*)—Intestinal worms.

ANIMAL SCHEME.

II. MOLLUSCA, subdivided into Mollusca and Molluscoida.

1. MOLLUSCA or Shell-fish Proper.

CEPHALOPODA (*Head-footed*)—Cuttle-fish, Octopus, Calamary, Nautilus.

PTEROPODA (*Wing-footed*)—Clio, Hyalæa.

GASTEROPODA (*Belly-footed*)—Snails, Slugs, Whelks, Cowries.

ACEPHALA (Headless)—Oysters, Mussels, Cockles, Shipworms.

BRACHIOPODA (Arm-footed)—Terebratulida, Lingula.

2. MOLLUSCOIDA, or Mollusc-like Animals.

TUNICATA (*Coated, but Shell-less*)— { Biphora, Simple and Compound
Ascidians.

POLYZOA (*Compound animals*) }
or
BRYOZOA (*Moss-like animals*) } Flustra, Eschara, Plumatella, &c.

BRYOZOA (*Moss-like animals*)

III. RADIATA or ZOOPHYTES—Ray-like Animals.

ECHINODERMATA (*Urchin-skinned*)—Sea-urchins, Star-fishes.

ACALEPHÆ (Sea-nettles)—Jelly-fish, Beroes.

POLYPI (*Many-feet*)—Coral animals, Sea-anemones, Hydraz.

IV. PROTOZOA or LOWEST-LIFE—Globular Animals.

INFUSOBIA (*Infusories*)—Monads, Volvoces, Vorticella.

PORIFERA (*Pore-bearers*)—Sponges, Fresh-water Sponges.

RHIZOPODA (Root-footed)—*Amœba*, *Polythalamia* (Foraminifera).

The following tabulations exhibit, in detail, the orders, families, and genera of those Classes which come most frequently under the notice of the Palæontologist, in order that the reader may perceive, at a glance, the relation which the extinct forms already determined bear to those still existing, and thus be in some measure enabled to arrive at broader conceptions of the great creational scheme of vitality:—

M A M M A L I A.

Sub-class I. PLACENTALIA—bringing forth perfect young.

Order I. BIMANA..... Man.

Sub-fossil—in recent formations only.

Order II. QUADRUMANA.

- | | | |
|-----------------------------|-----------------|--------------|
| Fam. 1. Galeopithecidae ... | Flying Lemurs. | |
| Fam. 2. Chiromyidae | Aye-Ayes. | |
| Fam. 3. Tarsidae | Thumbed Lemurs. | |
| Fam. 4. Nycticebidae | Slow Lemurs. | } Prosimiae. |
| Fam. 5. Lemuridae | Lemurs. | |
| Fam. 6. Haplorhinae | Marmosets. | |
| Fam. 7. Cebidae | New World Apes. | } Simiae. |
| Fam. 8. Simiidae | Old World Apes. | |

Fossil Forms. — *Pliopithecus*, *Dryopithecus*, *Mesopithecus*, *Sennopithecus*, and species of the existing genus *Macacus*.

Order III. CHEIROPTERA.

- | | |
|------------------------------|-----------------|
| Fam. 1. Vespertilionidae ... | True Bats. |
| Fam. 2. Rhinolophidae | Horseshoe Bats. |
| Fam. 3. Phyllostomidae ... | Vampyre Bats. |
| Fam. 4. Pteropodidae | Fox Bats. |

Fossil Forms. — Species of *Vespertilio*, *Rhinolophus*, and other existing genera in bone-caves.

Order IV. INSECTIVORA.

- | | |
|-------------------------|---------|
| Fam. 1. Talpidae | Moles. |
| Fam. 2. Soricidae | Shrews. |

ANIMAL SCHEME.

- Sub-fam. Soricinae True Shrews.
 „ Macroscelidinae Long-legged Shrews.
 „ Erinaceinae Hedgehogs.
 „ Tupaina Banrings.
- Fossil Forms.—*Palæospalax*, *Spalacodon*, *Spalacotherium*,
 and species of the existing genera *Erinaceus*, *Talpa*, and
Sorex.

Order V. CARNIVORA.

- | | | |
|----------------------------|------------|--------------------|
| Fam. 1. Canidæ | Dogs. | } Digitigrade. |
| Fam. 2. Felidæ | Cats. | |
| Fam. 3. Hyænidæ | Hyænas. | |
| Fam. 4. Viverridæ | Civets. | } Semiplantigrade. |
| Fam. 5. Mustelidæ | Weasels. | |
| Fam. 6. Melidæ | Badgers. | } Plantigrade. |
| Fam. 7. Ursidæ | Bears. | |
| Fam. 8. Cerculeptidæ | Kinkajous. | |
- Fossil Forms.—*Machairodus*, *Galecyne*, *Palæocyon*, *Amphi-*
cyon, *Hyænodon*, *Cynodon*, *Leptarctus*, and species of the
 existing genera *Canis*, *Vulpes*, *Felis*, *Hyæna*, *Putorius*,
Mustela, *Meles*, *Ursus*, &c.

Order VI. PINNIPEDIA.

- Fam. 1. Phocidæ Seals.
 Fam. 2. Tricheidæ Walruses.
- Fossil Forms.—Species of existing genus *Phoca*.

Order VII. RODENTIA.

- Fam. 1. Leporidæ Hares.
 Fam. 2. Cavidæ Cavies.
 Fam. 3. Hystricidæ Porcupines.
 Fam. 4. Castoridæ Beavers.
 Fam. 5. Muridæ Rats.
 Fam. 6. Psammorychidæ Sand-Rats.
 Fam. 7. Georychidæ Mole-Rats.
 Fam. 8. Chinchillidæ Chinchillas.
 Fam. 9. Dipopidæ Jerboas.
 Fam. 10. Myoxidæ Dormice.
 Fam. 11. Sciuridæ Squirrels.
- Fossil Forms.—*Trogontherium*, *Archæomys*, *Adelomys*, *Chali-*
comys, *Eumys*, *Plesiartomys*, and species of existing
 genera *Arvicola*, *Castor*, *Ardomys*, *Lagomys*, *Lepus*,
 and *Mus*.

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Order VIII. EDENTATA.

- Fam. 1. Myrmecophagidæ Ant-eaters.
 Fam. 2. Dasypodidæ Armadilloes.
 Fam. 3. Bradypodidæ Sloths.
 Fossil Forms.—*Glyptodon*, *Megatherium*, *Megalonyx*, *Mylo-*
don, *Macrotherium*, *Scelidotherium*, &c.

Order IX. RUMINANTIA.

- Fam. 1. Camelidæ..... Camels, Llamas.
 Fam. 2. Moschidæ..... Musk-deers.
 Fam. 3. Cervidæ Deers.
 Fam. 4. Camelopardidæ ... Giraffe.
 Fam. 5. Bovidæ..... Oxen, Sheep, Antelopes.
 Fossil Forms.—Several species of ox, sheep, goat, antelope,
 deer; *Megaceros*; species of musk-deer; species of camel;
 giraffe; *Leptauchenia*, *Macrauchenia*, *Dorcatherium*, *Siva-*
therium, *Merycotherium*, *Merycodus*, *Protomeryx*, *Camelops*,
 &c.

Order X. SOLIDUNGULA or SOLIPEDIA.

- Fam. 1. Equidæ..... Horses, Asses, Zebras.
 Fossil Forms.—*Anchitherium*, *Hipparion*, *Hippotherium*,
Merychippus; and species of the existing genera *Equus*
 and *Asinus*.

Order XI. PACHYDERMATA.

- Fam. 1. Elephantidæ Elephants. } Proboscidea.
 Fam. 2. Tapiridæ Tapirs.
 Fam. 3. Hippopotamidæ ... Hippopotami.
 Fam. 4. Rhinoceridæ..... Rhinoceroses.
 Fam. 5. Suidæ..... Swine.
 Fam. 6. Hyracidæ..... Conies.
 Fossil Forms.—*Palæotherium*, *Paloplotherium*, *Anoplother-*
ium, *Titanotherium*; *Hyopotamus*, *Chæropotamus*, *Micro-*
chærus; *Dichobune*, *Coryphodon*, *Dichodon*, *Oreodon*; *Hyr-*
acotherium; *Mammoth*, *Mastodon*; and several species of
 elephant, hippopotamus, rhinoceros, &c.

Order XII. CETACEA.

Sub-order I. CETE.

- Fam. 1. Balænidæ..... True Whales.
 Fam. 2. Physeteridæ Sperm Whales. } Zoophagous.
 Fam. 3. Delphinidæ Dolphins.

ANIMAL SCHEME.

Sub-order II. SIRENIA.

- Fam. 1. Rhytinidæ Rhytinea. }
 Fam. 2. Manatidæ..... Sea-cows. } Phytophagous.

Fossil Forms.—*Balanodon*, *Zeuglodon*, *Squalodon*; *Hali-therium*, *Dinotherium* (?), *Rhytina*; and sub-fossil species of existing genera *Balæna*, *Physter*, *Delphinus*, &c.

Sub-class II. APLACENTALIA—bringing forth imperfect young.

Order I. MARSUPIALIA.

- Fam. 1. Phascolomydæ ... Wombats. }
 Fam. 2. Macropodidæ Kangaroos. } Phytophagous.
 Fam. 3. Phalangistidæ..... Phalangers. }
 Fam. 4. Peramelidæ Bandicoots. }
 Fam. 5. Didelphidæ Opossums. } Rapa-
 Fam. 6. Myrmecobiidæ ... Banded Ant-Eaters. } cious.
 Fam. 7. Dasyuridæ Dasyures. }

Fossil Forms.—*Amphitherium*, *Phascolotherium*, *Dromatherium*, *Thylacotherium*, *Triconodon*, *Plagiaulax*, *Microlestes*, *Amphilestes*, *Nototherium*, *Diprotodon*, *Zygomaturus*, *Thylacoleo*; and sub-fossil species of existing genera.

Order II. MONOTREMATA.

- Fam. 1. Ornithorhynchidæ.. Ornithorhynchus.
 Fam. 2. Echidnidæ Porcupine Ant-Eaters.

AVES, OR BIRDS.

There is no other zoological form so slenderly represented in geological times as the Birds. The footprints of Runners and Waders are thought to occur on the slabs of the Trias; one doubtful portion of bone is said to have been found in the Upper Trias of America; an imperfect skeleton has been recently discovered in the Oolites of Germany; one questionable bone has been detected in the Chalk; and comparatively few bones and fragments in the Tertiaries. It is only in Post-tertiary times that bird-remains—bones and eggs—occur in anything like notable abundance. Whatever the cause, the paucity of ornithic remains is undoubted; and hence the merest *resumé* of the orders will suffice for paleontological purposes:—

Order I. **RAPTORES** or Seizers.—Remains of vulturine birds in the Tertiaries; *Lithornis*, &c.

Order II. **INSESSORES** or Perchers.—Remains of crow-like birds in the Upper Tertiaries.

Order III. **SCANSORES** or Climbers.—Remains of woodpecker-like birds in the Tertiaries.

Order IV. **COLUMBÆ** or Pigeons.—Remains of several genera in Post-tertiary and recent accumulations—some, like the *dodo*, *solitaire*, &c., of gigantic proportions.

Order V. **RASORES** or Scrapers.—Remains of quail-like and pheasant-like birds in the Tertiaries.

Order VI. **CURSORES** or Runners.—Remains of ostrich-like birds in the Tertiaries; and gigantic genera, *dinornis*, *aptornis*, *palapteryx*, &c., in the Post-tertiaries.

Order VII. **GRALLATORES** or Waders.—Remains of waders occur in some abundance in the Tertiaries, *gastornis*, *halcyornis*, &c.; and footprints (*Brontozoum*) are thought to be impressed on flagstones of Triassic date.

Order VIII. **NATATORES** or Swimmers.—Remains of this order (*ducks*, *gulls*, *auks*, *divers*, &c.) occur in the Tertiaries and Post-tertiaries in some abundance.

REPTILIA.

(After Professor Owen's arrangement of 1859.)

Order I. GANOCEPHALA (Head composed of enamelled bones).

Fossil Forms. — *Archegosaurus*, *Anthrakerpeton*, *Pholidogaster*, &c.

Order II. LABYRINTHODONTIA (Labyrinthine-teeth).

Fossil Forms. — *Labyrinthodon*, *Mastodonsaurus*, *Odontosaurus*, *Capitosaurus*, *Trematosaurus*, *Zygosaurus*, *Anthracosaurus*, *Baphetes*, *Bathygnathus*, &c.

Order III. ICHTHYOPTERYGIA (Fish-finned saurians).

Fossil Form. — *Ichthyosaurus*.

Order IV. SAUROPTERYGIA (Lizard-finned saurians).

Fossil Forms. — *Plesiosaurus*, *Pliosaurus*, *Simosaurus*, *Pistosaurus*, *Nothosaurus*, *Polyptychodon*.

Order V. ANOMODONTIA (Irregular-toothed).

Fam. 1. Dicynodontia..... *Dicynodon*, *Ptychognathus*.

Fam. 2. Cryptodontia..... *Oudenodon*.

Fam. 3. Gnathodontia..... *Rhynchosaurus*.

Fossil Forms. — As given in the preceding examples.

Order VI. PTEROSAURIA (Winged saurians).

Fossil Forms. — *Pterodactylus*, *Rhamphorhynchus*, *Dimorphodon*.

ANIMAL SCHEME.

Order VII. THECODONTIA (Sheath or socket-toothed).

Fossil Forms.—*Thecodontosaurus*, *Stagonolepis*, *Protorosaurus*, *Palæosaurus*, *Cladydon*, *Belodon*, &c.

Order VIII. DINOSAURIA (Terrible saurians).

Fossil Forms.—*Iguanodon*, *Hylæosaurus* (Herbivorous), *Megalosaurus*, *Regnosaurus* (Carnivorous), *Scelidosaurus*.

Order IX. CROCODYLIA (Crocodiles).

Sub-order 1. Amphicœlia..... Having bi-concave vertebræ.

Fossil Forms.—*Teleosaurus*, *Mistriosaurus*, *Macrospondylus*, *Massospondylus*, *Pelagosaurus*, *Stenosaurus*, *Suchosaurus*, *Goniopholis*, *Pæcilæpleura*, &c.

Sub-order 2. Opisthocœlia..... Having convexo-concave vertebræ.

Fossil Forms.—*Cetiosaurus*, *Streptospondylus*.

Sub-order 3. Proœlia..... Having concavo-convex vertebræ.

Fossil Forms.—Species of the existing genera *Crocodylus*, *Alligator*, and *Gavialis*.

Order X. LACERTILIA (Lizards).

Fam. 1. Scincidæ..... Skinks.

Fam. 2. Chalcidæ.....

Fam. 3. Lacertidæ..... Lizards.

Fam. 4. Teidæ..... Ameivas.

Fam. 5. Varanidæ..... Varanas.

Fam. 6. Iguanidæ..... Iguanas.

Fam. 7. Geckotidæ..... Geckos.

Fam. 8. Chamæleonidæ..... Chameleons.

Fossil Forms.—*Telerpeton*, *Dendrerpeton*, *Hylerpeton*, *Hylonomus*, *Leiodon*, *Macellodus*, *Lacerta*, *Coniosaurus*, *Dolichosaurus*, &c.

Order XI. OPHIDIA.

Fam. 1. Crotalidæ..... Rattlesnakes.

Fam. 2. Viperidæ..... Vipers.

Fam. 3. Colubridæ..... Snakes.

Fam. 4. Hydrophidæ..... Water-Snakes.

Fam. 5. Dendrophidæ..... Tree-Snakes.

Fam. 6. Boidæ..... Boas.

Fossil Forms.—*Palæophis*, *Laophis*, *Paleryx*; detached bones and eggs of undetermined genera apparently related to the water-snakes and pythons.

ANIMAL SCHEME.

Order XII. CHELONIA.

- Fam. 1. Chelonidæ..... Turtles..... Marine.
- Fam. 2. Tryonicidæ..... Soft Tortoises..... Fluvial.
- Fam. 3. Emydidæ..... Box Tortoises..... Marsh.
- Fam. 4. Testudinidæ..... Land Tortoises..... Terrestrial.

Fossil Forms.—*Colossochelys*, *Pleurosternon*, *Protomys*, *Platemys*; fossil footprints, as *Chelichnus*, &c.; and species of the existing genera *Chelone*, *Testudo*, *Tryonix*, and *Emys*.

Order XIII. BATRACHIA OR AMPHIBIA.

Sub-order I. APODA.

- Fam. 1. Cœciliidæ..... Blindworms.
- Fam. 2. Lepidotidæ..... Lepidosiren.

Sub-order II. URODELA.

- Fam. 1. Proteidæ..... Proteus.
- Fam. 2. Sirenidæ..... Sirens.
- Fam. 3. Amphiumidæ..... Amphiuma.
- Fam. 4. Salamandridæ..... Tritons.

Fossil Forms.—*Parabatrachus*, *Palæophrynos*, *Andrias*, &c.

Sub-order III. ANURA.

- Fam. 1. Pipidæ..... Surinam Toads.
- Fam. 2. Bufonidæ..... Toads.
- Fam. 3. Ranidæ..... Frogs.
- Sub-fam.—Hylinæ..... Tree-Frogs.

Fossil Forms.—*Raniceps*; *Batrachopus*, *Sauropus*, and other frog-like footprints.

PISCES, OR FISHES.

(Chiefly from *Morris's Catalogue of British Fossils*, as modified from
Müller and Owen.)

Order I. DERMOPTERI. [*Cycloidei*, Agass.]

Sub-order I. Pharyngobranchii, seu *Cirrhostomi*.

Fam. 1. Amphioxidæ Lancelet.

Sub-order II. Marsipobranchii. [*Cyclostomi*, Cuv.]

Fam. 1. Myxinidæ..... Myxine.

Fam. 2. Petromyzontidæ..... Lamprey.

Order II. MALACOPTERI (*Physostomi*, Müller). [*Cycloidei*, Agass.]

Sub-order I. M. apodes.

Fam. 1. Symbranchidæ Cuchia.

Fam. 2. Muraenidæ Eel.

Fam. 3. Gymnotidæ Gymnotus.

Sub-order II. M. abdominales.

Fam. 1. Heteropygii Amblyopsis.

Fam. 2. Clupeidæ Herring.

Fam. 3. Salmonidæ..... Salmon.

Fam. 4. Scopelidæ Saurus.

Fam. 5. Characinidæ Myletes.

Fam. 6. Galaxidæ..... Galaxias.

Fam. 7. Esocidæ Pike.

Fam. 8. Mormyridæ Mormyrus.

Fam. 9. Cyprinodontidæ Umber.

Fam. 10. Cyprinidæ Carp.

Fam. 11. Siluridæ Sheat-fish.

Order III. PHARYNGOGNATHI (Müller). [*Cycloidei et Ctenoidei*, Agass.]

Sub-order I. Ph. malacopterygii.

Fam. 1. Scomber-esocidæ Saury-Pike.

Sub-order II. Ph. acanthopterygii.

Fam. 1. Chromidæ..... Chromis.

Fam. 2. Cycloabridæ Wrasse.

Fam. 3. Ctenolabridæ Pomacentrus.

ANIMAL SCHEME.

Order IV. ANACANTHINI (Müller). [*Cycloidei et Ctenoidei*, Agass.]

Sub-order I. A. apodes.

Fam. 1. Ophidiidæ Ophidium.

Sub-order II. A. thoracica.

Fam. 1. Gadidæ Cod.

Fam. 2. Pluroneotidæ Plaice.

Order V. ACANTHOPTERI (Müller). [*Cycloidei et Ctenoidei*, Agass.]

Fam. 1. Percidæ Perch.

Fam. 2. Sclerogenidæ Gurnard.

Fam. 3. Sparidæ Sparus.

Fam. 4. Scisidæ Maigre.

Fam. 5. Labyrinthobranchii Anabas.

Fam. 6. Mugilidæ Mullet.

Fam. 7. Notacanthidæ Notacanth.

Fam. 8. Scomberidæ Mackerel.

Fam. 9. Squammipennes Chætodon.

Fam. 10. Tsenioidæ Riband-fish.

Fam. 11. Theutyidæ Lancet-fish.

Fam. 12. Fistularidæ Pipe-mouth.

Fam. 13. Gobiidæ Goby.

Fam. 14. Blenniidæ Wolf-fish.

Fam. 15. Lophiidæ Angler.

Order VI. PLECTOGNATHI (Cuvier). [*Ganoidei*, Agass.]

Fam. 1. Balistini File-fish.

Fam. 2. Ostraciontidæ Trunk-fish.

Fam. 3. Gymnodontidæ Globe-fish.

Order VII. LOPHOBRANCHII (Cuvier). [*Ganoidei*, Agass.]

Fam. 1. Hippocampidæ Sea-horse.

Fam. 2. Syngnathidæ Pipe-fish.

Order VIII. GANOIDEI, seu *Goniolepidoti* (Agass.; as restricted by Müller).

Chiefly Fossil Forms.

Fam. 1. Salamandroidæ Lepidosteus and Polypterus.
(*Sauroidæ*, Agass.)

Fam. 2. Pycnodontidæ Pycnodus.

Fam. 3. Lepidoidei Dapedius.

Fam. 4. Sturionidæ Sturgeon. (*Acipenserini*, Agass.)

Fam. 5. Acanthodei Acanthodes.

Fam. 6. Dipteridæ Dipterus. (*Sauroidæ*-dipterini, Agass.)

Fam. 7. [*Cœlacanthi*, Agass. *Cœlacanthus*.]

Fam. 8. Cephalaspides Cephalaspis, Pteraspis.

Order IX. PROTOPTERI. [*Ganoidei*, Agass.]

Fam. 1. Sirenoidei Lepidosiren.

ANIMAL SCHEME.

Order X. HOLOCEPHALI. [*Placoides*, Agass.]

- | | |
|-------------------------------------|------------|
| Fam. 1. <i>Chimaeridae</i> | Chimæra. |
| Fam. 2. <i>Edaphodontidae</i> | Edaphodon. |

Order XI. PLAGIOSTOMI. [*Placoides*, Agass.]

- | | |
|---------------------------------------|-------------------|
| Fam. 1. <i>Hybodontidae</i> | Hybodus. |
| Fam. 2. <i>Cestraciontidae</i> | Cestracion. |
| Fam. 3. <i>Notidanidae</i> | Grey Shark. |
| Fam. 4. <i>Spinacidae</i> | Piked Dog-fish. |
| Fam. 5. <i>Scylliidae</i> | Spotted Dog-fish. |
| Fam. 6. <i>Nictitantes</i> | Tope. |
| Fam. 7. <i>Lamnidae</i> | Porbeagle. |
| Fam. 8. <i>Alopeciidae</i> | Fox Shark. |
| Fam. 9. <i>Scymniidae</i> | Greenland Shark. |
| Fam. 10. <i>Squatinae</i> | Monk-fish. |
| Fam. 11. <i>Zygænidae</i> | Hammerhead Shark. |
| Fam. 12. <i>Pristidae</i> | Saw-fish. |
| Fam. 13. <i>Rhinobatidae</i> | Rhinobates. |
| Fam. 14. <i>Torpedinidae</i> | Electric Ray. |
| Fam. 15. <i>Raidæ</i> | Skate. |
| Fam. 16. <i>Trygonidae</i> | Sting Ray. |
| Fam. 17. <i>Myliobatidae</i> | Eagle Ray. |
| Fam. 18. <i>Cephalopteridae</i> | Cephalopterus. |

INSECTA.

Frail and fragile as they may seem, the insect tribes are nevertheless pretty numerous represented in all the formations, from the Coal-measures upwards. The following outline of the leading Orders may assist the student in his discriminations :—

1. *Furnished with hard coriaceous jaws or mandibles.*

Order I. HYMENOPTERA, having four membranous veined wings, the anterior the larger ; as the Bee, Humble-bee, Wasp.

Order II. NEUROPTERA, having four similar membranous reticulated wings, as the Dragon-fly, Termes, Caddis-fly, Day-fly.

Fossil genera (Libellula, Ephemera, Phryganea, &c.) have been found in the Coal, Oolite, and Tertiaries.

Order III. ORTHOPTERA, having the wings straight and the outer pair a little coriaceous, as the Locust, Grasshopper, Cock-roach.

Fossil genera of this order (Blattina, Gryllus, Dictyoneura, &c.) have been found in the Coal, Oolite, and Tertiaries.

Order IV. COLEOPTERA, having the outer wings wholly coriaceous and neatly meeting along the back, so as to form a sheath or shield for the inner pair when at rest, as in the various Beetles.

Fossil genera (Carabus, Curculioides, Elater, &c.) have been found in the Coal, Oolite, Wealden, and Tertiaries.

ANIMAL SCHEME.

2. *Furnished with sucking mouths and probosces.*

Order V. **HEMIPTERA**, having the outer wings coriaceous for about half their length only, as the Squash-bug, or uniformly thin, as in the Crickets.

Fossil genera are said to occur in the Oolite and Fresh-water Tertiaries.

Order VI. **DIPTERA**, having two membranous wings only, as the House-fly.

Fossil genera (*Asilus, Culex, Rhyphus, &c.*) have been found in the Lias and Purbeck beds of England.

Order VII. **LEPIDOPTERA**, having large wings covered with minute scales, as the Butterflies and Moths.

Fossil genera are said to occur in the Tertiaries.

CRUSTACEA.

(*Extinct Families and Genera are printed in Italics.*)

Sub-Class I.—ENTOMOSTRACA.

Legion 1. LOPHYPODA.

Order 1. COPEPODA.

Fam. 1. Cyclopidae.

Order 2. OSTRACODA.

Fam. 1. Cyprididae.

Genus *Cypris*.

Candona.

Cypridea.

Fam. 2. Cytheridae.

Genus *Cythere*.

Sub-genus *Bairdia*.

Cytheridea.

Cythereis.

Cytherella.

Fam. 3. Cypridinidae.

Genus *Cypridina*.

Cypridella.

Cyrella.

Daphnoidea.

Legion 2. BRANCHIOPODA.

Order 1. CLADOCERA.

Fam. 1. Daphniadæ.

Genus *Daphnia*, &c.

Order 2. PHYLLOPODA.

Fam. 1. Linnadiadæ.

Genus *Limnadia*.

Estheria.

Leperditia.

Beyrichia.

Pellocaris.

Fam. 2. Nebaliadæ.

Genus *Nebalia*.

Ceratiocaris.

Hymenocaris.

Kampecaris.

Fam. 3. Apodidæ.

Genus *Apus*.

Dithyrocaris.

Fam. 4. Branchiopodidæ.

Genus *Cheirocephalus*, &c.

Extinct Group. *Trilobita*.

Fam. *Harpedidæ*.

Paradoxidæ.

Prothidæ.

Asaphidæ.

Phacopidæ.

Calymenidæ.

Lichadiidæ.

Trinucleidæ.

Acidaspidæ.

Cheiruridæ.

Bronteidæ.

Agnostidæ.

Legion 3. PÆCILOPODA.

Fam. 1. Limulidæ.

Genus *Limulus*, &c.

Extinct Fam. 2. *Eurypterida*.

Genus *Eurypterus*.

Pterygotus.

Stimonia.

Stylonurus.

Legion 4. SIPHONOSTOMATA.

Sub-Class II.—MALACOSTRACA.

Legion 1. PODOPTHALMIA.

Order 1. DECAPODA.

Fam. 1. Brachyura=Crabs,
&c.

Fam. 2. Anomura=Hermit
Crab, &c.

Fam. 3. Macrura=Lobster,
&c.

Order 2. STOMAPODA=Squills, &c.

Legion 2. EDRIOPHTHALMIA.

Order 1. AMPHIPODA=Gammar-
us, &c.

Order 2. LÆMIPODA = Caprella,
&c.

Order 3. ISOPODA=Oniscus, &c.

MOLLUSCA.

(Modified from Woodward's Manual,—the fossil families and genera being printed in *Italics*.)

CLASS I.—CEPHALOPODA.

Order I. DIBRANCHIATA = ACETABULIFERA (CUTTLE-FISHES.)

a. OOTOPODA.

Fam. 1. Argonautidæ.—Argonauta.

Fam. 2. Octopodidæ.—Octopus, Pinnoctopus, Eledone, Cirroteuthis, Philonexis.

b. DECAPODA.

Fam. 3. Teuthidæ.—Loligo, Gonatus, Sepioteuthis, *Beloteuthis*, *Geoteuthis*, *Leptoteuthis*, Cranchia, Sepiola, Lolligopsis, Cheiroteuthis, Onychoteuthis, Enoploteuthis, Ommastrephes.

Fam. 4. *Belemnitidæ*.—*Belemnites*, *Belemnitella*, *Acanthoteuthis*, *Belemnoteuthis*, *Conoteuthis*.

Fam. 5. Sepiadæ.—Sepia, *Spirulirostra*, *Beloptera*, *Belemnosis*.

Fam. 6. Spirulidæ.—Spirula.

Order II. TETRABRANCHIATA = TENTACULIFERA (NAUTILOID CEPHALOPODS).

Fam. 1. Nautilidæ.—Nautilus, *Lituiles*, *Trochoceras*, *Clymenia*.

Fam. 2. *Orthoceratidæ*.—*Orthoceras*, *Gomphoceras*, *Oncoceras*, *Phragmoceras*, *Cyrtoceras*, *Gyroceras*, *Ascoceras*.

Fam. 3. *Ammonitidæ*.—*Goniatites*, *Bactrites*, *Ceratites*, *Ammonites*, *Crioceras*, *Turrilites*, *Hamites*, *Ptychoceras*, *Baculites*.

CLASS II.—PTEROPODA.

a. THECASOMATA.

Fam. 1. Hyalidæ.—Hyalea, Cleodora, Cuvieria, *Theca*, *Pterotheca*, *Conularia*, Eurybia, Cymbulia, Tiedemannia.

Fam. 2. Limacinidæ.—Limacina, Spirialis.

b. GYMNOBOMATA.

Fam. 3. Clidæ.—Clio, Pneumodermon, Pelagia, Cymodocea.

ANIMAL SCHEME.

CLASS III.—GASTEROPODA.

Order I. PROSOBRANCHIATA.

a. SIPHONOSTOMATA.

- Fam. 1. Strombidae.—*Strombus*, *Pteroceras*, *Rostellaria*, *Seraphs*.
Fam. 2. Muricidae.—*Murex*, *Pisania*, *Ranella*, *Triton*, *Fasciolaria*,
Turbinella, *Cancellaria*, *Trichotropis*, *Pyrula*, *Fusus*.
Fam. 3. Buccinidae.—*Buccinum*, *Pseudoliva*, *Anolax*, *Halia*, *Terebra*,
Eburna, *Nassa*, *Phos*, *Ringicula* (?), *Purpura*, *Purpurina*,
Monoceros, *Pedicularia*, *Ricinula*, *Planaxis*, *Magilus*, *Cassis*,
Oniscia, *Cithara*, *Cassidaria*, *Dolium*, *Harpa*, *Columbella*,
Oliva, *Ancillaria*.
Fam. 4. Conidae.—*Conus*, *Pleurotoma*.
Fam. 5. Volutidae.—*Voluta*, *Cymba*, *Mitra*, *Volvaria*, *Marginella*.
Fam. 6. Cypræidae.—*Cypræa*, *Erato*, *Ovulum*.

b. HOLOSTOMATA.

- Fam. 1. Naticidae.—*Natica*, *Sigaretus*, *Lamellaria*, *Narica*, *Velutina*.
Fam. 2. Pyramidellidae.—*Pyramidella*, *Odostomia*, *Chemnitzia*,
Eulima, *Stylina*, *Loxonema*, *Macrocheilus*.
Fam. 3. Cerithiidae.—*Cerithium*, *Potamides*, *Nerinea*, *Fastigiella*,
Aporrhais, *Struthiolaria*.
Fam. 4. Melaniidae.—*Melania*, *Paludomus*, *Melanopsis*.
Fam. 5. Turritellidae.—*Turritella*, *Aclis*, *Cæcum*, *Vermetus*, *Siliquaria*,
Scalaria.
Fam. 6. Litorinidae.—*Litorina*, *Solarium*, *Phorus*, *Lacuna*, *Litiopa*,
Rissoa, *Skenea*, *Truncatella* (?), *Lithoglyphus*.
Fam. 7. Paludinae.—*Paludina*, *Ampullaria*, *Amphibola*, *Valvata*.
Fam. 8. Neritidae.—*Nerita*, *Pileolus*, *Neritina*, *Navicella*.
Fam. 9. Turbinidae.—*Turbo*, *Phasianella*, *Imperator*, *Trochus*,
Rotella, *Monodonta*, *Delphinula*, *Adeorbis*, *Euomphalus*, *Stomatella*,
Broderipia.
Fam. 10. Haliotis.—*Haliotis*, *Stomatia*, *Scissurella*, *Pleurotomaria*,
Murchisonia, *Trochotoma*, *Cirrus*, *Ianthina*.
Fam. 11. Fissurellidae.—*Fissurella*, *Puncturella*, *Rimula*, *Emarginula*,
Parmophorus.
Fam. 12. Calyptræidae.—*Calyptræa*, *Crepidula*, *Pileopsis*, *Hipponyx*.
Fam. 13. Patellidae.—*Patella*, *Acmæa*, *Gadinia*, *Siphonaria*.
Fam. 14. Dentaliidae.—*Dentalium*.
Fam. 15. Chitonidae.—*Chiton*.

Order II. PULMONIFERA.

a. INOPERCUATA.

- Fam. 1. Helicidae.—*Helix*, *Vittrina*, *Succinea*, *Bulimus*, *Achatina*,
Pupa, *Cylindrella*, *Balea*, *Tornatellina*, *Paxillus*, *Clausilia*.
Fam. 2. Limacidae.—*Limax*, *Inciliaria*, *Arion*, *Farmacella*, *Tes-*
tacella.
Fam. 3. Onchidiidae.—*Oncidium*, *Vaginulus*.

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Fam. 4. *Limnæidæ*.—*Limnæa*, *Chilinia*, *Physa*, *Ancylus*, *Planorbis*.

Fam. 5. *Auriculidæ*.—*Auricula*, *Conovulus*, *Carychium* (*Siphonaria*).

b. OPERCULATA.

Fam. 6. *Cyclostomidæ*.—*Cyclostoma*, *Ferussina* (?), *Cyclophorus*, *Pupina*, *Helicina*, *Stoastoma*.

Fam. 7. *Aciculidæ*.—*Acicula*, *Geomelania*.

Order III.—OPISTHOBRANCHIATA.

a. TECTIBRANCHIATA.

Fam. 1. *Tornatellidæ*.—*Tornatella*, *Cinulia*, *Ringicula*, *Globiconcha*, *Varigera*, *Tylostoma*, *Pterodonta* (?), *Tornatina* (?).

Fam. 2. *Bullidæ*.—*Bulla*, *Acera*, *Cylichna*, *Amphisphyra*, *Aplustrum*, *Scaphander*, *Bullæa*, *Doridium*, *Gastropteron*.

Fam. 3. *Aplysiadæ*.—*Aplysia*, *Dolabella*, *Notarchus*, *Icarus*, *Lo-biger*.

Fam. 4. *Pleurobranchidæ*.—*Pleurobranchus*, *Posterobranchæa*, *Runcina*, *Umbrella*, *Tylodina*.

Fam. 5. *Phyllidiadæ*.—*Phyllidia*, *Diphyllidia*.

b. NUDIBRANCHIATA.

Fam. 6. *Doridæ*.—*Doris*, *Goniodoris*, *Triopa*, *Ægirus*, *Thecacera*, *Polycera*, *Idalia*, *Ancula*, *Ceratosoma*.

Fam. 7. *Tritoniadæ*.—*Tritonia*, *Scyllæa*, *Tethys*, *Bornella*, *Dendronotus*, *Doto*, *Melibæa*, *Lomanotus*.

Fam. 8. *Æolidæ*.—*Æolia*, *Glaucus*, *Fiona*, *Embletonia*, *Proctonotus*, *Antiopa*, *Hermæa*, *Alderia*.

Fam. 9. *Phyllirhoidæ*.—*Phyllirhoe*.

Fam. 10. *Elysiadæ*.—*Elysia*, *Acteonina*, *Cenia*, *Limapontia*.

Order IV. NUCLÉOBRANCHIATA.

Fam. 1. *Firolidæ*.—*Firola*, *Carinaria*, *Cardiropoda*.

Fam. 2. *Atlantidæ*.—*Atlanta*, *Porcellia*, *Bellerophon*, *Cyrtolites*, *Maclurea* (?).

CLASS IV.—ACEPHALA = CONCHIFERA.

a. ASIPHONIDA.

Fam. 1. *Ostreidæ*.—*Ostrea*, *Anomia*, *Placuna*, *Pecten*, *Lima*, *Spondylus*, *Pedum*, *Plicatula*.

Fam. 2. *Aviculidæ*.—*Avicula*, *Posidonomya*, *Aviculopecten*, *Ger-villia*, *Perna*, *Inoceramus*, *Pinna*.

Fam. 3. *Mytilidæ*.—*Mytilus*, *Myalina*, *Modiola*, *Lithodomus*, *Crenella*, *Dreissena*.

Fam. 4. *Arcadæ*.—*Arca*, *Cucullæa*, *Pectunculus*, *Limopsis*, *Nucula*, *Isoarca*, *Leda*, *Solenella*, *Solemya*.

Fam. 5. *Trigoniadæ*.—*Trigonia*, *Myophoria*, *Azinus*, *Lyrodesma*.

Fam. 6. *Unionidæ*.—*Unio*, *Castalia*, *Anodon*, *Iridina*, *Mycetopus*, *Ætheria*, *Mülleria*.

b. SIPHONIDA ; Integro-pallialia.

Fam. 7. *Chamidæ*.—*Chama*, *Monopleura*, *Diceras*, *Requienia*.

ANIMAL SCHEME.

- Fam. 8. *Hippuritidæ*.—*Hippurites*, *Radiolites*, *Caprinella*, *Caprina*, *Caprotina*, *Maclurea* (?).
- Fam. 9. *Tridacnidæ*.—*Tridacna*, *Hippopus*.
- Fam. 10. *Cardiadæ*.—*Cardium*, *Hemicardium*, *Lithocardium*, *Serripes*, *Adacna*, *Conocardium*.
- Fam. 11. *Lucinidæ*.—*Lucina*, *Cryptodon*, *Corbis*, *Tancredia*, *Dip-lodonta*, *Ungulina*, *Kellia*, *Montacuta*, *Lepton*, *Galeomma*.
- Fam. 12. *Cycladidæ*.—*Cyclas*, *Cyrenoides*, *Cyrena*.
- Fam. 13. *Cyprinidæ*.—*Cyprina*, *Circe*, *Astarte*, *Crassatella*, *Iso-cardia*, *Cypricardia*, *Pleurophorus*, *Cardilia*, *Megalodon*, *Pachydorus*, *Pachyrisma*, *Opis*, *Cardinia*, *Myoconcha*, *Hippopodium*, *Cardita*, *Venericardia*, *Verticordia*.
- c. SIPHONIDA ; Simu-pallialia.
- Fam. 14. *Veneridæ*.—*Venus*, *Cytherea*, *Meroe*, *Trigona*, *Gratelou-pia*, *Artemis*, *Lucinopsis*, *Tapes*, *Venerupis*, *Petricola*, *Glaucomya*.
- Fam. 15. *Mactridæ*.—*Mactra*, *Gnathodon*, *Lutraria*, *Anatinella*.
- Fam. 16. *Tellinidæ*.—*Tellina*, *Diodonta*, *Capsula*, *Psammobia*, *Sanguinolaria*, *Semele*, *Syndosmya*, *Serobicularia*, *Mesodesma*, *Ervilia*, *Donax*, *Galatea*.
- Fam. 17. *Solenidæ*.—*Solen*, *Cultellus*, *Ceratisolen*, *Machæra*, *Sole-curtus*, *Novaculina*.
- Fam. 18. *Myacidæ*.—*Mya*, *Corbula*, *Sphenia*, *Nesera*, *Thetis*, *Panopea*, *Saxicava*, *Glycimeris*.
- Fam. 19. *Anatinidæ*.—*Anatina*, *Cochlodesma*, *Thracia*, *Phola-domya*, *Myacites*, *Goniomya*, *Ceromya*, *Cardiomorpha*, *Edmondia*, *Lyonsia*, *Pandora*, *Myadora*, *Myochama*, *Chamos-trea*.
- Fam. 20. *Gastrochænidæ*.—*Gastrochæna*, *Chæna*, *Clavagella*, *As-pergillum*.
- Fam. 21. *Pholadidæ*.—*Pholas*, *Pholadidea*, *Jouannetia*, *Xylopha-ga*, *Teredo*, *Teredina*.

CLASS V.—BRACHIOPODA.

- Fam. 1. *Terebratulidæ*.—*Terebratula*, *Terebratella*, *Argiope*, *The-cidium*, *Stringocephalus*.
- Fam. 2. *Spiriferidæ*.—*Spirifera*, *Athyris*, *Retzia*, *Uncites*.
- Fam. 3. *Rhynchonellidæ*.—*Rhynchonella*, *Camarophoria*, *Penta-merus*, *Atrypa*.
- Fam. 4. *Orthis*.—*Orthis*, *Strophomena*, *Leptæna*, *Koninckia*, *Davidsonia*, *Calceola*.
- Fam. 5. *Productidæ*.—*Producta*, *Aulosteges*, *Strophalosia*, *Chonetes*.
- Fam. 6. *Craniadæ*.—*Crania*.
- Fam. 7. *Discinidæ*.—*Discina*, *Siphonotreta*.
- Fam. 8. *Lingulidæ*.—*Lingula*, *Obolus*.

* * All the Brachiopodous families occur largely in a fossil state ; the genera, species, and individuals, being much more abundant in Palæozoic than in Mesozoic or Cainozoic times.

MOLLUSCOIDA.

CLASS I.--TUNICATA : doubtfully known in a fossil state.

CLASS II.—BRYOZOA or POLYZOA.

- Fam. 1. Escharidæ.—*Eschara*, *Ptilodictya*, *Glaucanome*, *Lunulites*, *Vincularia*.
- Fam. 2. Celleporidæ.—*Cellepora*, *Flustra*, *Lepralia*, *Discopora*, *Escharina*.
- Fam. 3. Reteporidæ.—*Retepora*, *Fenestella*, *Polypora*, *Phyllopora*, *Ptilopora*, *Synocladia*.
- Fam. 4. Crisidæ.—*Crisia*, *Idmonea*, *Hippothoa*.
- Fam. 5. Myriaporidæ.—*Fascicularia*, *Terebellaria*, *Theonoe*.
- Fam. 6. Tubuliporidæ.—*Tubulipora*, *Heteropora*, *Ceripora*, *Actinopora*, *Diastopora*, *Cricopora*, *Petallopora*, *Pustulopora*, *Zonopora*.

ECHINODERMATA.

(*Fossil Families and Examples printed in Italics.*)

Order I. CRINOIDEA.

Examples.

- Fam. 1. Comatulidæ..... Comatula.
- Fam. 2. *Marsupitidæ*..... *Marsupites*.
- Fam. 3. *Apiocrinidæ*..... *Apiocrinus*, *Bourgueticrinus*, *Millericrinus*.
- Fam. 4. Pentacrinidæ..... Pentacrinus, *Extracrinus*, *Cainocrinus*.
- Fam. 5. *Cyathocrinidæ*..... *Cyathocrinus*, *Potericrinus*, *Rhodocrinus*,
Taxocrinus.
- Fam. 6. *Melocrinidæ*..... *Actinocrinus*, *Hexacrinus*, *Platycrinus*.
- Fam. 7. *Cupressocrinidæ*..... *Cupressocrinus*.
- Fam. 8. *Polycrinidæ*..... *Eucalyptocrinus*.

Order II. CYSTOIDEA.

- Fam. 1. *Cystidæ*..... *Pseudocrinites*, *Hemicosmites*, *Caryocistites*,
Echinospærites.

Order III. BLASTOIDEA.

- Fam. 1. *Pentremitidæ*..... *Pentremites*, *Codonaster*, *Eleacrinus*.

Order IV. OPHIUROIDEA.

- Fam. 1. Ophiuridæ..... *Ophiura*, *Amphiura*, *Aspidura*, *Ophio-*
derma, *Protaster*.

Order V. ASTEROIDEA.

- Fam. 1. Asteridæ..... *Asterias*, *Astropecten*, *Goniaster*, *Oreaster*,
Solaster, *Uraster*.
- Fam. 2. Crenasteridæ..... *Crenaster*, *Euryale*.

Order VI. PERISCHO-ECHINOIDEA.

- Fam. 1. *Palæchinidæ*..... *Palæchinus*.
- Fam. 2. *Archæocidaridæ*..... *Archæocidaris*, *Perischodomus*.

ANIMAL SCHEME.

Examples.

Order VII. ECHINOIDEA.

- | | |
|---------------------------|--|
| Fam. 1. Echinidæ | Echinus, <i>Cyphosoma</i> , <i>Diadema</i> , <i>Discoidea</i> ,
<i>Echinopus</i> , <i>Hemiaster</i> , <i>Hemicidaris</i> , <i>Sa-</i>
<i>lenia</i> . |
| Fam. 2. Cidaridæ | Cidaris. |
| Fam. 3. Galeritidæ | <i>Galerites</i> , <i>Dysaster</i> , <i>Holactypus</i> , <i>Hyboclypus</i> . |
| Fam. 4. Echinoneidæ | <i>Echinocyamus</i> , <i>Echinarachnius</i> . |
| Fam. 5. Cassidulidæ | <i>Nucleolites</i> , <i>Pygaster</i> , <i>Pygurus</i> . |
| Fam. 6. Ananchytidæ | <i>Ananchytes</i> , <i>Cardiaster</i> , <i>Hemipneustes</i> . |
| Fam. 7. Spatangidæ | <i>Spatangus</i> , <i>Microster</i> , <i>Schizaster</i> . |

Order VIII. HOLOTHURIOIDEA.

- | | |
|---------------------------|-----------------------------|
| Fam. 1. Holothuridæ | Holothuria, <i>Psolus</i> . |
| Fam. 2. Synaptidæ | Synaptis. |

ZOOPHYTA.

POLYPI=ANTHOZOA=CŒLENTERATA.

(*Fossil Families and Examples printed in Italics.*)

Sub-class I. CORALLARIA = ACTINOZOA.

Order I. ZOANTHARIA.

Sect. a. APOROSA.

- Fam. 1. *Turbinolidae*.—*Turbinolia*, *Cyathina*, *Cyclocyathus*, *Discocyathus*.
- Fam. 2. *Oculinidae*.—*Oculina*, *Diphelia*, *Synhelia*.
- Fam. 3. *Astræidae*.—*Astræa*, *Cladophyllia*, *Montlivaltia*, *Parasmilia*.
- Fam. 4. *Fungidae*.—*Fungia*, *Anabacia*, *Micrabacia*.

Sect. b. PERFORATA.

- Fam. 1. *Eupsammidae*.—*Balanophyllia*, *Stephanophyllia*.
- Fam. 2. *Madreporidae*.—*Stereopsammia*, *Dendrophyllia*.
- Fam. 3. *Poritidae*.—*Holoræa*, *Litharæa*, *Pleurodictyum*.

Sect. c. TABULATA.

- Fam. 1. *Milleporidae*.—*Millepora*, *Astræopora*, *Heliolites*.
- Fam. 2. *Favositidae*.—*Favosites*, *Alveolites*, *Chaetetes*, *Halysites*.
- Fam. 3. *Seriatoporidae*.—*Dendropora*.
- Fam. 4. *Thecidae*.—*Thecia*, *Columnaria*.

Sect. d. RUGOSA.

- Fam. 1. *Stauridae*.—*Stauria*, *Polyscia*, *Holocystis*.
- Fam. 2. *Cyathoxonidae*.—*Cyathoxonia*.
- Fam. 3. *Cyathophyllidae*.—*Cyathophyllum*, *Acervularia*, *Amplexus*, *Clisiophyllum*, *Lithodendron*, *Lithostrotion*, *Zaphrentis*, &c.
- Fam. 4. *Cystiphyllidae*.—*Cystiphyllum*.

Sect. e. CAULICULATA.

- Fam. 1. *Antipathidae*.—*Antipathes*.

ANIMAL SCHEME.

Order II. ALCYONARIA.

- Fam. 1. Alcyonidæ.—Alcyonium, *Cladochonus*.
- Fam. 2. Tubiporidæ.—Tubipora, *Stromatopora*.
- Fam. 3. Gorgonidæ.—Gorgonia, *Mopsea*, *Pyrilonema*, *Virgularia*,
Protovirgularia.
- Fam. 4. *Graptolitidæ*.—*Graptolithus*, *Didymograpsus*, *Diplograpsus*, *Rastriles*.
- Fam. 5. Pennulatidæ.—Pennatula, *Graphularia*.

Order III. PODACTINARIA.—

Sub-class II. HYDROIDEA=HYDROZOA.

- Fam. 1. Hydridæ.—Hydra.
- Fam. 2. Sertularidæ.—Sertularia.
- Fam. 3. Corynidæ.—Coryne.
- Fam. 4. Calycophoridæ.—
- Fam. 5. Physophoridæ.—
- Fam. 6. Lucernidæ.—Lucernaria.
- Fam. 7. Medusidæ.—Medusa, *Cyanea*, *Equorea*.

PORIFERA = AMORPHOZOA = SPONGIÆ .

(Sponge-like organisms occurring most abundantly in British formations.)

Fam. AMORPHOSPONGIDÆ.

Gen. Acanthospongia.

Achilleum.

Plocoscyphia.

Spongia.

Steganodictyum.

Talpina.

Tragos.

Fam. CALCISPONGIDÆ.

Gen. Grantia.

Fam. HALICHONDRIIDÆ.

Gen. Cliona.

Cnemidium.

Cœloptychium.

Conis.

Coscinopora.

Halichondria.

Fam. LYMNOREIDÆ.

Gen. Mammillopora.

Fam. SPARSISPONGIDÆ.

Gen. Chenendopora.

Manon.

Fam. SIPHONIDÆ.

Gen. Choanites.

Hippalimus.

Jerea.

Paramondra.

Polypothecia.

Scyphia.

Siphonia.

Verticillites.

Fam. VENTRICULIDÆ.

Gen. Brachiolites.

Cephalites.

Guettardia.

Ventriculites.

RHIZOPODA = POLYTHALAMIA = FORAMINIFERA.

(*Foraminifera whose calcareous cases occur most abundantly in British strata*).

Ord. 1. MONOSTEGIA.	Operculina.
Gen. <i>Lagena</i> .	Planorbulina.
	Planulina.
Ord. 2. CYCLOSTEGIA.	Pyrulina.
Gen. <i>Orbiculina</i> .	Robulina.
<i>Orbitalina</i> .	Rosalina.
<i>Orbitolites</i> .	Rotalina.
	Spirolina.
Ord. 3. STICHOSTEGIA.	Truncatulina.
Gen. <i>Dentalina</i> .	Verneulina.
<i>Frondicularia</i> .	
<i>Glandulina</i> .	Ord. 5. ENTOMOSTEGIA.
<i>Lingulina</i> .	Gen. <i>Amphistegina</i> .
<i>Margulinulina</i> .	<i>Robertina</i> .
<i>Nodosaria</i> .	
<i>Vaginulina</i> .	Ord. 6. ENALLOSTEGIA.
<i>Webbina</i> .	Gen. <i>Cuneolina</i> .
	<i>Globulina</i> .
Ord. 4. HELICOSTEGIA.	<i>Guttulina</i> .
Gen. <i>Alvelolina</i> .	<i>Polymorphina</i> .
<i>Anomalina</i> .	<i>Sagrina</i> .
<i>Bulimina</i> .	<i>Textularia</i> .
<i>Cristellaria</i> .	<i>Vulvulina</i> .
<i>Eudothyra</i> .	
<i>Flabellina</i> .	Ord. 7. AGATHESTEGIA.
<i>Guadryina</i> .	Gen. <i>Biloculina</i> .
<i>Globigerina</i> .	<i>Fusulina</i> .
<i>Lituola</i> .	<i>Quinqueloculina</i> .
<i>Nonionina</i> .	<i>Spiroloculina</i> .
<i>Nummulites</i> .	<i>Triloculina</i> .

* * The Polycystina, an allied group, are furnished with *siliceous* and not with *calcareous* shells.

GEOLOGICAL SCHEME.

All our ideas of geological arrangement are founded on the fact, that in the earth's crust there are two great sets of rocks, the STRATIFIED and the UNSTRATIFIED—the former the results of deposition in water, and hence also known as *Aqueous* and *Sedimentary*, the latter the products of igneous fusion, and consequently termed *igneous* and *eruptive*, thus :—

- I. STRATIFIED, SEDIMENTARY, AQUEOUS, or NEPTUNIAN—the results of deposition in water, and consequently arranged in layers or strata more or less persistent and regular, as sandstone, shale, limestone, coal, and the like.
- II. UNSTRATIFIED, ERUPTIVE, IGNEOUS, or PLUTONIC—the products of igneous fusion, and cast forth, for the most part, in irregular and amorphous masses, as granite, greenstone, basalt, lava, and the like.

The following arrangement of the STRATIFIED FORMATIONS is that which gave direction and consistency to the researches of British Geologists during the earlier portion of the present century—is still, in part, retained in its nomenclature, and continues less or more to influence our ideas of succession and chronology :—

- | | | |
|-------------|---|---|
| FORMATIONS. | { | <p>RECENT.—All superficial accumulations, as sand, gravel, silt, marl, peat-moss, coral-reefs, &c. <i>Contain the remains of existing plants and animals only partially fossilised or sub-fossil.</i></p> <p>TERTIARY.—Local and limited deposits of regular strata occurring above the Chalk. <i>Contain the remains of plants and animals not differing widely in character from those now existing.</i></p> <p>SECONDARY.—Embracing all the strata known as Chalk, Oolite, Lias, Coal-measures, Mountain Limestone, and Old Red Sandstone. <i>Contain fossil plants and animals of species totally different from those now existing.</i></p> <p>TRANSITION.—Strata of slaty and siliceous sandstones, known as “greywackè,” calcareous shales, and limestones. <i>Contain few or no fossil plants, and the remains of no higher animals than crustacea, shell-fish, and zoophytes.</i></p> <p>PRIMARY.—All slaty and crystalline strata—as roofing-slate, mica-schist, and gneiss, very hard and compact, and totally destitute of organic remains.</p> |
|-------------|---|---|

GEOLOGICAL SCHEME.

Although the Igneous rocks burst through and appear among the stratified without order or arrangement, it is customary to speak of them as GRANITIC, TRAPPEAN, and VOLCANIC; meaning, by the term Granitic, the igneous rocks which, like granite, are usually found associated with the older strata; by the term Trappean, the igneous rocks most frequently associated with the Secondary and Tertiary strata; and by the term Volcanic, those that have made their appearance during the current epoch. Classifying them according to this view, we have—

GROUPS.	{	VOLCANIC.—Lava, trachyte, tufa, pumice, scorice, &c., associated with recent accumulations.
		TRAPPEAN.—Trap-tuff, amygdaloid, greenstone, basalt, &c., associated for the most part with Tertiary and Secondary strata.
		GRANITIC.—Granite, syenite, porphyry, &c., associated in greatest force with Transition and Primary strata.

By a more extensive examination of the strata in different countries, and especially by a more minute investigation of their fossil contents, the “formations” of the earlier geologists have, to a certain extent, become obsolete, and other subdivisions and groupings been adopted. This new arrangement has been founded either on mineral or on fossil distinctions—such differences being sufficient to warrant the conclusion that each set of strata was formed during successive epochs, under different distributions of sea and land, and consequently under different conditions of climate and other modifying influences; and as geological investigation advances, it is more than probable that we must still farther abandon our *Rock Formations*, and adhere to great *Life Periods* as the true exponents of the world's progress and history. In the mean time the following arrangement gives consistency to the researches of European and American geologists:—

<i>Systems.</i>		<i>Periods.</i>		<i>Cycles.</i>	
1. Post-Tertiary.	}	CAINOZOIC (Recent Life).	}	NEOZOIC.	
2. Tertiary.					
3. Cretaceous.	}	MESOZOIC (Middle Life).	}		
4. Oolitic or Jurassic.					
5. Triassic.	}		}		
6. Permian.	}	PALÆOZOIC (Ancient Life).	}	PALÆOZOIC.	
7. Carboniferous.					
8. Devonian or Old Red.					
9. Silurian.					
10. Cambrian.	}		}		
11. Laurentian.					
12. Metamorphic, Crystalline, or Non-fossiliferous.	}	AZOIC (Void of Life).	}		

GEOLOGICAL SCHEME.

BRITISH STRATIFIED SYSTEMS.

The following tabulation exhibits the arrangement of the British stratified rocks, as accepted by our leading geologists—minor and local deviations of superposition being subordinated for the sake of distinct comprehension and ready reference:—

	<i>Systems.</i>	<i>Groups.</i>	<i>Periods.</i>	
OF VOLCANIC	POST-TERTIARY.	{ In progress. Recent.	CAINOZOIC.	NEOZOIC CYCLE.
	TERTIARY.	{ Pleistocene. Pliocene. Miocene. Eocene.		
RANGE OF TRAPPEAN ROCKS	CRETACEOUS.	{ Chalk. Greensand.		
	OOLITIC.	{ Wealden. Oolite. Lias.	MESOZOIC.	
TRIASSIC.	{ Saliferous Marls. Muschelkalk (?). Upper New Red Sandstone.			
RANGE OF GRANITIC ROCKS	PERMIAN.	{ Magnesian Limestone. Lower New Red Sandstone.	PALÆOZOIC.	
	CARBONIFEROUS.	{ Coal-measures. Millstone Grit. Mountain Limestone. Lower Coal-measures.		
RANGE OF GRANITIC ROCKS	DEVONIAN.	{ Yellow Sandstones. Devonian Limestones and Schists. Red Sandstones, Conglomerates, and Cornstones. Grey fissile Sandstones ("flagstones") and Conglomerates.			PALÆOZOIC CYCLE.
	SILURIAN.	{ Upper Silurian. Lower Silurian.		
RANGE OF GRANITIC ROCKS	CAMBRIAN.	Schists and Grits.		
	LAURENTIAN.	Hard Gneissic Schists, &c.		
	METAMORPHIC.	{ Clay-slate, Mica-schist, Gneiss, and Granitoid Schists.	AZOIC, OR HYPOZOIC.	

GEOLOGICAL SCHEME.

TABLE OF EUROPEAN FOSSILIFEROUS STRATA.

(After Sir Charles Lyell, 1865.)

1. Recent.	}	POST-TERTIARY.	TERTIARY OR CAINOZOIC.	NEOZOIC.		
2. Post-Pliocene.						
3. Newer Pliocene.	}	PLIOCENE.				
4. Older Pliocene.						
5. Upper Miocene.	}	MIOCENE.				
6. Lower Miocene.						
7. Upper Eocene.	}	Eocene.				
8. Middle Eocene.						
9. Lower Eocene.						
10. Maestricht Beds.	}	CRETACEOUS.	SECONDARY OR MESOZOIC.	NEOZOIC.		
11. White Chalk.						
12. Upper Greensand.						
13. Gault.	}	JURASSIC.				
14. Lower Greensand.						
15. Wealden.						
16. Purbeck Beds.	}	TRIASSIC.				
17. Portland Stone.						
18. Kimmeridge Clay.						
19. Coral Rag.	}	TRIASSIC.	PRIMARY OR PALÆOZOIC.	PALÆOZOIC.		
20. Oxford Clay.						
21. Great or Bath Oolite.						
22. Inferior Oolite.	}	PERMIAN.				
23. Lias.						
24. Upper Trias.						
25. Middle Trias.	}	CARBONIFEROUS.				
26. Lower Trias.						
27. Permian.	}	DEVONIAN.				
28. Coal-measures.						
29. Carboniferous Limestone.	}	SILURIAN.				
30. Upper						
31. Middle	}	CAMBRIAN.				
32. Lower						
33. Upper	}	LAURENTIAN.				
34. Middle						
35. Lower	}	LAURENTIAN.				
36. Upper						
37. Lower	}	LAURENTIAN.				
38. Upper						
39. Lower	}	LAURENTIAN.				

GÉOLOGICAL SCHEME.

AGES GÉOLOGIQUES.

(After D'Orbigny, 1852.)

<i>Terrains.</i>	<i>Étages.</i>	<i>British Equivalents.</i>
EPOQUE ACTUELLE.	,,	CURRENT EPOCH.
	27. Subapennin	Red and Coralline Crag of Suffolk.
TERTIARIES.	26. Falunien	— —
	25. Parisien	Upper and Middle Eocenes
	24. Suessonien	Lower Eocene.
	23. Danien	— —
CRÉTACÉS.	22. Sénonien	Upper White Chalk.
	21. Turonien	Lower White Chalk.
	20. Cénomanién	Upper Greensand.
	19. Albien	Gault.
	18. Aptien	Lower Greensand, in part.
	17. Néocomien	Do. and Wealden.
	16. Portlandien	Portland Group.
JURASSIQUES.	15. Kimméridgien	Kimmeridge Clay.
	14. Corallien	Coral Rag.
	13. Oxfordien	Oxford Clay.
	12. Callovien	Kelloway Rock.
	11. Bathonien	Bath Oolite.
	10. Bajocien	Inferior Oolite.
	9. Toarcien	Upper Lias.
	8. Liasien	Middle Lias; Marlstone.
TRIASIQUES.	7. Sinemurien	Lower Lias.
	6. Saliférien	Saliferous Marls.
	5. Conchylien	Variegated Sandstones, in part; Upper New Red.
PALÉOZOIQUES.	4. Permien	Magnesian Limestone, &c.
	3. Carboniférien	Coal-Measures.
	2. Devonien	Old Red Sandstone.
	1. Silurien { Supérieur	Upper Silurian.
	Inférieur	Lower Silurian.

GEOLOGICAL SCHEME.

STRATIFIED ROCKS OF NORTH AMERICA.

(After Marcou, Bigsby, and Logan.)

<i>Stages.</i>	<i>Sections.</i>	<i>British Equivalents.</i>
UPPER.	{ Peat-Mosses and Savannahs.	POST-TERTIARY.
LOWER.	{ River Alluvia and Deltas.	
	Superficial Gravels and Raised Beaches.	
UPPER.	{ Boulder Formation of the Northern States and Canada.	TERTIARY.
MIDDLE.	{ Clays and Sands of North Carolina, &c.	
LOWER.	{ Greensand and Marls of Maryland, &c.	
	{ Limestones and Clays of the Carolinas, &c.	
	Yellow Limestone and Greensand of New Jersey, &c.	CRETACEOUS.
	Sandstones, Shale, and Coal of Richmond, Virginia.	OOLITIC (?).
UPPER.	Red Sandstones of Connecticut, Mass. &c.	TRIASSIC (?).
LOWER.	{ Do. of Chatham, N. Carolina, &c.	PERMIAN (?).
UPPER.	Coal-formation or Coal-measures.	CARBONIFEROUS.
MIDDLE.	Lower Carboniferous Limestone.	
	Sandstones and Conglomerates of Pennsylvania.	
LOWER.	{ Gypsum, Marls, and Conglomerates of Nova Scotia.	
UPPER.	Old Red Sandstone.	DEVONIAN.
MIDDLE.	{ Chemung Rocks; Portage Sandstone; Genesee Slate; Tully Limestone; Hamilton Rocks; Marcellus Shales.	
	Carboniferous Limestone; Onondago Limestone; Schoharie Grit; Caudigalli Grit; Oriskany Limestone.	
LOWER.		
UPPER.	{ Upper Pentamerus Limestone; Delthyris shaly Limestone; Lower Pentamerus Limestone; Waterlime Rocks; Onondago Salt Rock; Coralline Limestone, Schoharie; Niagara Shale and Limestone.	SILURIAN.
MIDDLE.	{ Clinton Rocks; Medina Sandstone; Oneida Conglomerate.	
LOWER.	{ Hudson-River Rocks; Utica Slate; Trenton Limestone; Birdseye Limestone; Chazy Limestone; Calciferous Sandstone; Potsdam Sandstone.	
	Huronian Sandstones; Conglomerates; Chloritic and Quartzose Schists; Crystalline Limestones.	CAMBRIAN.
	Laurentian Gneissoid and Hornblende Schists; Quartzites, Crystalline Limestones, and Serpentine.	LAURENTIAN.

GEOLOGICAL SCHEME.

PALÆOZOIC ROCKS OF PENNSYLVANIA.

(After Professor H. D. Rogers, 1859.)

	<i>Appalachian Series.</i>	<i>New York Names.</i>	<i>British Equivalents, nearest.</i>
UPPER.	{ Seral, Umbral, Vespertine,.....	{ " " "	CARBONIFEROUS.
MIDDLE.	{ Ponent, Vergent, Cadent, Post-Meridian, ... Meridian,	{ Catskill Group. Chemung Group. Hamilton Group. Upper Helderberg Limestone. Oriskany Sandstone.	DEVONIAN.
	{ Pre-Meridian, ... Scalent, Surgent,..... Levant,	{ Lower Helderberg Limestone. Niagara Group. Clinton Group. Medina Group.	SILURIAN.
LOWER.	{ Matinal, Auroral, Primal,	{ Hudson and Trenton Riv. Gr. { Blue River, Chazy, and Calci- ferous Sandstone Groups. Potsdam Sandstone.	CAMBRIAN.

"These fifteen formations, or *series* of deposits," says Professor Rogers, "defined by their prevalent organic remains, and by the physical horizons which separate them as sediments, are called by names significant of their relative ages—the words employed suggesting metaphorically the different periods of the day. Thus, beginning with the lowest or earliest, they mean respectively Dawn, Daybreak, Morning, Sunrise, Mounting-day, Climbing-day, Forenoon, Noon, Afternoon, Declining-day, Descending-day, Sunset, Evening, Dusk, and Nightfall. Some such nomenclature, *based on time*, is, for many reasons, preferable to the inexpressive ones which rest for the most part on geographical terms, only locally correct, or on narrow and inconstant palæontological characters."

GEOLOGICAL SCHEME.

CONTEMPORARY OR EQUIVALENT DEPOSITS.

I. POST-TERTIARY OR QUATERNARY SYSTEM.

	<i>British.</i>	<i>Foreign.</i>
HISTORIC.	<p>Peat of Great Britain and Ireland, with human remains, &c.</p> <p>Fens, marshes, and river-deposits, with ancient canoes, implements, &c.</p> <p>Lake-silts, fresh-water marls, &c., with canoes, metal implements, remains of domesticated animals, &c.</p> <p>Accumulations of sand-drift, shore-cave- and beach-deposits, considerably beyond the reach of existing tides.</p>	<p>Terrain quaternaire of French authors, in part.—Modern portion of Deltas of Rhine, Nile, Ganges, Mississippi, &c.—Marine strata enclosing temple of Serapis at Puzzuoli.—Fresh-water strata enclosing temple in Cashmere.—Tundras of Siberia; Tarai or Jungle soil of India; Cypress swamps, &c. of America.—Modern part of coral-reefs of Red Sea and Pacific.—Travertine of Italy; calcareous tufa of Guadaloupe; and Lavas of Vesuvius and Etna, over-spreading objects of human art, &c.</p>
PREHISTORIC.	<p>Peat-moss, Lake-silts, and other alluvia, with tree-canoes, pile-dwellings, and stone implements.</p> <p>Alluvia and river-deposits, with remains of Irish-deer, wild oxen, mammoth, and other extinct mammals.</p> <p>Cave-deposits in part, with bones of extinct mammals, stone implements, and fragments of charred wood.</p>	<p>Terrain quaternaire of French authors, in part.—Upper river-gravels of the Somme, Seine, &c., with flint implements, and bones of extinct mammalia.—Upper Alluvia of Tigris and Euphrates.—River silt of Upper Egypt in part.—Upper portion of cave-deposits of France, Belgium, Mediterranean, and Southern Europe, with stone implements and charred wood.—Plain of Holland in part; plain of China in part; and much of the river-alluvia of America.—Dinornis silts of New Zealand.</p>

GEOLOGICAL SCHEME.

	<i>British.</i>	<i>Foreign.</i>
POST- GLACIAL.	<p>Shell-marl under peat, and submarine forests of modern trees.</p> <p>Raised beaches at various heights, with species of shells more boreal than those of existing seas.</p> <p>Ancient alluvia and gravel of most of our carse, straths, dales, and holmes—the “Brick Clay” of many authors. Contains remains of seals, whales, &c. ; and of extinct land mammals, as mammoth, rhinoceros, urus, &c.</p> <p>Cave-deposits in part, with bones of extinct and living carnivora and herbivora—ursus, hyæna, megaceros, rhinoceros, hippopotamus, &c. No human remains.</p>	<p>Loess of the Rhine, with recent fresh-water shells and mammoth bones.—Volcanic tufa of Ischia, with living species of marine shells, and without human remains or works of art.—Newer boulder formation in Sweden.—Bluffs of the Mississippi.—Driftwood and mammoth-gravel of the Arctic seas.—Tchornozem or black-earth of the Aralo-Caspian plain.—Upper portion of great Chinese plain.—Auriferous Drift, in part, of the Uralian, Australian, and Californian gold-fields.</p>

II. TERTIARY SYSTEM.

PLEISTOCENE OR NEWER PLIOCENE.	<p>Glacial drift or boulder formation of Norfolk, of the Clyde, of North Wales—the “Boulder Clay” of many authors.—Norwich Crag.—Cave-deposits of Kirkdale, &c. with bones of extinct and living quadrupeds.</p>	<p>Terrain quaternaire, diluvium. Terrain tertiaire supérieur.—Glacial drift of Northern Europe; of Northern United States; and Alpine erratics.—Limestone of Girgenti Kunkur of India (?); Australian cave-breccias.</p>
OLDER PLIOCENE.	<p>Red Crag of Suffolk, Coral-line Crag of Suffolk.</p>	<p>Sub-Appennine strata.—Hills of Rome, Monte Mario, &c.—Antwerp and Normandy Crag.—Aralo-Caucasian deposits, older part.—Pampas Formation of South America, &c.</p>
UPPER MIOCENE.	<p>Marine strata of this age wanting in the British Islands.—Ferruginous sands of North Downs (?).</p>	<p>Falunien supérieur.—Faluns of Touraine.—Part of Bordeaux beds.—Bolderberg strata in Belgium.—Part of Vienna Basin.—Part of Molasse in Switzerland.—Sands of James River and Richmond, Virginia.—Green-sands and marls of Maryland, United States.</p>

GEOLOGICAL SCHEME.

	<i>British.</i>	<i>Foreign.</i>
LOWER MIOCENE.	Hempstead beds near Yarmouth, Isle of Wight. Lignites and clays of Bovey, in Devonshire. Leaf-bed of Mull. Lignites of Antrim.	Lower part of Terrain tertiaire moyen.—Calcaire lacustre supérieur, and grès de Fontainebleau.—Part of the Lacustrine strata of Auvergne.—Limburg beds, Belgium.—(Rupelian and Tertiary system of Dumont). Mayence Basin. Part of brown coal of Germany.—Hermendorf tile-clay, near Berlin. Lignites of New Zealand (?).
UPPER EOCENE.	1. Bembridge or Binsted Beds, Isle of Wight. 2. Osborne or St Helens series. 3. Headon Series. 4. Headon Hill sands and Barton clay.	1. Gypseous series of Montmartre, and Calcaire lacustre supérieur. 2 and 3. Calcaire Silicieux. 2 and 3. Grès de Beauchamp, orsables moyens.—Læcken beds, Belgium. 4. Upper and Middle Calcaire grossier.
MIDDLE EOCENE.	1. Bagshot and Bracklesham Beds. 2. White clays of Alum Bay, Isle of Wight.	1. Bruxillien or Brussels Beds of Dumont. 1. Lower Calcaire grossier, or glauconie grossière. 1. Caiborne beds, Alabama. 1 and 2. Nummulitic formation of Europe, Asia, &c. 2. Soissonais Sands, or Lits Coquilliers.
LOWER EOCENE.	1. London Clay and Bognor Beds. 2. Plastic and mottled clays and sands; Woolwich Beds. 3. Thanet Sands.	1. Wanting in Paris Basin, occurs at Cassel in French Flanders.—Limestones and Clays of the Carolinas (?). 2. Argile Plastique et Lignite. 3. Lower Landenian of Belgium, in part.

III. CRETACEOUS SYSTEM.

MAESTRICHT BEDS.	Wanting in England.	Danien of d'Orbigny. Calcaire pisolitique, Paris. Maestricht Beds. Coralline limestone of Faxoe in Denmark.
UPPER WHITE CHALK.	White Chalk, with flints.	Senonien of d'Orbigny. Obere Kreide and Upper Quader-sandstein of the Germans. La Scaglia of the Italians. Yellow Limestone and Greensand of New Jersey, in part.

GEOLOGICAL SCHEME.

	<i>British.</i>	<i>Foreign.</i>
LOWER WHITE CHALK.	Chalk without flints. Chalk Marl.	Turonian of d'Orbigny. Calcaire à hippurites, Pyre- nées. Upper Pläner Kalk of Saxony. Yellow Limestone and Green- sand of New Jersey, in part. Limestones of the West Indies and Colombia, S. America.
UPPER GREENSAND.	(Loose sand, with bright green grains. Forestone of Merstham, in Surrey. Marly stone, with Chert, Isle of Wight.	Cénomanen of d'Orbigny. Gres Vert Supérieur. Craie Chloritée. Lower Quadersandstein of the Germans.
GAULT.	(Dark-blue Marl, Kent. Folkestone Marl. Black Down Beds (sand- stone and chert), Devon- shire.	Albien of d'Orbigny. Glauconie Crayeuse. Lower Pläner Kalk of Saxony. Strata of the Saskatchewan prairies and Vancouver's Island.
LOWER GREENSAND.	(Greensand of Kent and Sussex. Limestone (Kentish Rag). Sands and Clay, with cal- careous concretions and chert, Atherfield, Isle of Wight. Speeton Clay, Yorkshire.	Gres Vert Inférieur. Neocomien Supérieur. Aptien of d'Orbigny. Hills Conglomerat of Germany. Hils-thon of Brunswick.
WEALDEN.	(Clay, with occasional bands of limestone and sand- stone; Weald of Kent, Surrey, and Sussex. Sand, with calcareous grit and clay; Hastings, Cuckfield, Sussex.	Neocomien Inférieur. Formation Waldienne. Wälderformation of North Germany.

IV. OOLITIC OR JURASSIC SYSTEM.

UPPER OOLITE.	1. Purbeck Beds. 2. Portland Stone and Sand. 3. Kimmeridge Clay.	1. Serpuliten Kalk and Wal- derformation of N. Ger- many, in part.—2. Portlan- dien of d'Orbigny.—3. Kim- meridgien of d'Orbigny.— Calcaire à gryphées virgules, of Thirria.—Argiles de Hon- fleur de de Beaumont.
MIDDLE OOLITE.	1. Calcareous Grit. 2. Coral Rag. 3. Oxford Clay. 4. Kelloway Rock.	1 and 2. Corallien of Beudant and d'Orbigny.—Calcaire à Nerinnées of Thurmann.— 3. Oxfordien Supérieur.—4. Oxfordien Inférieur or Cal- lovien of d'Orbigny.

GEOLOGICAL SCHEME.

	<i>British.</i>	<i>Foreign.</i>
LOWER OOLITE.	<ol style="list-style-type: none"> 1. Cornbrash and Forest Marble. 2. Great (or Bath) Oolite and Stonesfield Slates. 3. Fuller's Earth, Bath. 4. Calcareous Freestone and Yellow Sands (Inferior Oolite). 	<ol style="list-style-type: none"> 1 and 2. Bathonian; Grand Oolithe; Calcaire de Caen. 3 and 4. Oolithe inférieur; Oolithe ferrugineux of Normandy; Oolithe de Bayeux; Bajocien of d'Orbigny.
LIAS.	<ol style="list-style-type: none"> 1. Upper Lias. 2. Marlstone. 3. Lower Lias. 	<ol style="list-style-type: none"> 1. Toarcien of d'Orbigny. 2. Lias Moyen; Liasien of d'Orbigny. 4. Calcaire à gryphée arquée; Sinemurien of d'Orbigny; Coal-field of Richmond, Virginia (?); and Coal-fields of India (?).

V. TRIASSIC SYSTEM.

UPPER.	<ol style="list-style-type: none"> Bone-bed of Axmouth; Dolomitic Conglomerate of Bristol; Saliferous and Gypseous Shales and Sandstones of Cheshire. 	<ol style="list-style-type: none"> Saliferien of d'Orbigny; Marnes irisées of the French; St Cassian or Rhaetic beds; Keuper of the Germans. Coal-fields of Richmond, Virginia, and of Chatham, North Carolina.
MIDDLE.	<ol style="list-style-type: none"> Wanting in England. 	<ol style="list-style-type: none"> Conchylien of d'Orbigny, in part; Calcaire à Cératites of Cordier; Muschelkalk of Germany.
LOWER.	<ol style="list-style-type: none"> Red and White Sandstones and Quartzose Conglomerates of Lancashire and Cheshire. White sandstones of Lossiemouth and Cummingstone, Morayshire (?). 	<ol style="list-style-type: none"> Bunter Sandstein of the Germans; Grès bigarré of the French; Conchylien of d'Orbigny, in part; Red Sandstones of Connecticut, U.S.

VI. PERMIAN SYSTEM.

MAGNESIAN LIMESTONE.	<ol style="list-style-type: none"> 1. Laminated and Concretionary Limestones of York and Durham. 2. Brecciated Limestone do. 3. Fossiferous Limestone. 4. Compact Limestone, do. 5. Marl-slate of Durham. 	<ol style="list-style-type: none"> 1. Stinkstein of Thuringia. 2. Rauchwackè do. 3. Dolomit or Upper Zechstein. 4. Zechstein proper. 5. Mergel or Kupfer schiefer.
RED SANDSTONE.	<ol style="list-style-type: none"> Red Sandstones, Grits, and Marls; Dolomitic Conglomerate of Bristol, Exeter, Annandale, &c. 	<ol style="list-style-type: none"> Rothliegendes of Thuringia. Permian sandstones, conglomerates, and magnesian limestones of Russia. Grès des Voyages of French.

GEOLOGICAL SCHEME.

VII. CARBONIFEROUS SYSTEM.

	<i>British.</i>	<i>Foreign.</i>
UPPER.	{ 1. Upper or True Coal-Measures. }	1. Coal-fields of the United States.
MIDDLE.	{ 1. Millstone Grit of England. 2. Mountain or Carboniferous Limestone. }	2. Calcaire Carbonifère of the French.—Bergkalk or Kohlenkalk of the Germans.—Pentremite Limestone, U.S.
LOWER.	{ 1. Lower Coal-measures and "Calcareous Sandstones" of Scotland.—Lower Limestone Shale, Mendips.—Carboniferous Slates of Ireland. }	1. Kiesel Schiefer and Jüngere Grauwacke of the Germans. Gypseous Beds and Eocrinital Limestones of Nova Scotia.—Cypridina Schiefer of Nassau, Saxony, &c.

VIII. DEVONIAN OR OLD RED SANDSTONE.

UPPER.	{ 1. Yellow Sandstones of Dura Den, Fifeshire; Kilkenny Ireland; and Pilton and Petherwyn Groups Devonshire. 2. White and chocolate-coloured Sandstones and Grits of Berwick and Roxburgh. }	1. Upper Devonians of Russia; Cypridina Schiefer of Germany, in part. 2. Catskill Group, U.S.
MIDDLE.	{ 1. Red Sandstones and Marls of Fife, Perth, Forfar, Hereford, &c. 2. Middle Schists and Limestones of Devonshire. 3. Micaceous and Bituminous Flags of Caithness. }	1. Eifel Limestone; and Upper and Middle Devonians of Russia, in part. 2 and 3. Middle Devonians of Russia, in part; Chemung, Genesee, and Hamilton Groups, North America.
LOWER.	{ 1. Lower Devonian of North Devon. 2. Grey Flagstones of Perth and Forfar. Great Pebbly conglomerate of Scotland; Tilestones of Hereford, in part. }	1. Spirifer Sandstone and Slate. 2. Russian Devonian, lower part; and Onondago and Oriskany Groups, North America.

IX. SILURIAN SYSTEM.

UPPER.	{ 1. Upper Ludlow Rocks; Lesmahago Tilestones. 2. Aymestry Limestone. 3. Lower Ludlow. 4. Wenlock Limestone and Shale. 5. Llandovery Rocks. }	{ 1-5. Upper stages of Bohemian Basin; E to H of Barrande. 1-3. Pentamerus, Delthyris, and Onondago Groups, New York.—4. Schoharie Coraline Limestone.—5. Medina Sandstone. }
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GEOLOGICAL SCHEME.

	<i>British.</i>	<i>Foreign.</i>
LOWER.	<ol style="list-style-type: none"> 1. Caradoc Sandstone. 2. Bala Beds. 3. Llandeillo and Lingula Flags. 4. Longmynd or "Bottom Rocks." 	<ol style="list-style-type: none"> 1 and 3. Lower stages of Bohemian Basin; C and D Barrande. — 4. Primordial zone of Barrande; Slates of Angers, France. — 1-4. From Oneida Conglomerates to Potsdam Sandstone inclusive.

X. CAMBRIAN SYSTEM.

UPPER.	<ol style="list-style-type: none"> { Fossiliferous Schists of Wicklow; Schists and Slates of North Wales. 	<ol style="list-style-type: none"> { Alum Schists of Sweden; lowest fossiliferous rocks of Wisconsin and Minnesota.
LOWER.	<ol style="list-style-type: none"> { Lower Grits and Schists of Dumfries; and Grits, Schists, and Conglomerates of Northern Highlands. 	<ol style="list-style-type: none"> { Huronian Sandstones and Chloritic and Gneissic Schists.

XI. LAURENTIAN SYSTEM.

UPPER.	<ol style="list-style-type: none"> { Gneiss and Crystalline Schists of the Northern Hebrides; Hypersthene rocks of Skye, &c. 	<ol style="list-style-type: none"> { Gneissic and hornblende Schists of the St Lawrence and Adirondack Mountains.
LOWER.	<ol style="list-style-type: none"> { (?) 	<ol style="list-style-type: none"> { Gneissic Schists, quartzites, crystalline limestones and serpentines of the Laurentide Mountains, Canada.

II

GENERAL TERMS AND TECHNICALITIES



GENERAL TERMS AND TECHNICALITIES.

A — ABN

A.—In words derived from the Greek, the prefix *a* is used privatively, or in a negative sense, and has the effect of the English word *without*, as *apodous*, without feet; *acephalous*, without a head; *acotyledonous*, having no seed-lobes; and *asac*, destitute of organic remains.

Abbeville Flints.—Rude flint implements in the form of spear-heads, &c., found in great abundance in the Post-Tertiary sands and gravels of the Somme, in the neighbourhood of Abbeville. These were first discovered in 1847, by M. Boucher de Perthes, associated with bones of extinct mammalia in such a way as to lead him to the inference that the flint implement makers and the Mammoth (*Elephas primigenius*), the Tichorhine Rhinoceros, Hippopotamus Major, Irish Elk (*Megaceros Hibernicus*), &c., had been contemporaneous—an inference that has since been corroborated by similar discoveries in other parts of Europe.

Abdómen (Lat. *abdo*, I conceal).—In animals, the belly or cavity containing the viscera. **Abdominal.**—Pertaining to the belly.

Abdominales (Lat. *abdo*, I conceal; hence *abdomen*, the belly).—In the zoological arrangement of Cuvier, a section of the *Malacopterygian*, or soft-finned fishes, which have their ventral fins placed on the abdomen, behind the pectorals. The section includes the carps, the silures, the salmones, the herrings, and the pikes.

Abérrant (Lat. *ab*, and *erro*, I wander from).—Applied in natural history classification to those species ("aberrant species") which differ widely from the type of the natural group or family to which they belong, or rather under which they are usually arranged.

Abietites (Lat. *abies*, the fir-tree).—A genus of coniferæ occurring in the Wealden and Lower Greensand. The genus has been founded chiefly on the fossil cones, which are often found in great perfection—these cones being composed of scales that terminate in a point, and not in a rhomboidal disc as in *Pinus*, which see.

Abnórma, Abnormous (Lat. *ab*, from, and *norma*, a rule).—Without rule or order; irregular; in a condition differing from that produced in the regular course of nature; deviating from the general type or form; not

occurring in the usual order, or according to that which is generally considered as the natural law. **Abnórmity**.—Irregularity, deformity.

Aborigines (Lat. *ab*, from; *origo*, a beginning or origin).—The first or primitive inhabitants of a country; the original stock (flora or fauna) of any geographical area. **Aboriginal**.—First, primitive, original.

Abortive (Lat. *abortio*, a miscarriage).—Failing to arrive at a state of perfection or maturity; applied in botany and zoology to such organs as appear only in an imperfect or rudimentary state, or which stop short at a certain stage of their growth, and never attain to full or perfect development.

Abranchiáta (Gr. *a*, without, and *branchia*, gills).—Applied to animals which have no apparent external organs of respiration, as the leech, earth-worm, &c., and which respire by the entire surface of the skin, or by internal cavities. The *Abranchiata* constitute the third order of the Annelida of Cuvier. The term *Abranchia* has also been applied to certain amphibia, as the *menopoma* and *amphiuma*, which do not undergo metamorphosis, but breathe by lungs during the whole of their existence.—See BRANCHIA and its compounds.

Abrásion (Lat. *ab*, from, and *rasus*, rubbed or scraped).—The operation of wearing away by rubbing or friction. Currents of water laden with sand, shingle, and other rock-debris are the chief abrading agents in nature. Abrasion may also result from the passage of icebergs, the descent of glaciers, &c.; hence the frequency of abraded rock-surfaces in connection with the Boulder-clay. *Abrasion*, as a geological result, presents some important distinctions, as compared with *Denudation* and *Degradation*, which see.

A'brazi'te (Gr. *a*, without; *brazo*, to bubble).—One of the Zeolite family, known also as *zeagonite* and *gismondine*, and so named from its not effervescing under the blowpipe. Its crystals occur in hemispherical bundles in the cavities of volcanic rocks; are of a greyish-white to a reddish-brown or red colour; and consist essentially of silica, alumina, lime, and potash.

Ab'sórbent (Lat. *ab*, and *sorbeo*, I suck in).—Capable of sucking in fluids; in geology, applied to soils, rocks, and minerals which have the quality of readily imbibing water into their pores and interstices.

Ab'stér'gent (Lat. *abstergo*, I cleanse).—Having a cleansing property; fuller's earth is an abstergent.

Acalé'phæ (Gr. *akaléphe*, a nettle).—A zoological term for the soft gelatinous radiata known as medusæ, sea-nettles, jelly-fish, &c. The term has reference to the property which many of them possess, of causing, when touched, a hot stinging sensation like that produced by the nettle.

Acánthodes (Gr. *akantha*, a spine or thorn).—One of Agassiz's genera of ganoid fishes occurring from the lower Old Red Sandstone to the Permian, inclusive, and characterised by its thorn-like ichthyodorousites or fin-spines. The type of the family *Acanthodidae*, in which all the fins are furnished with strong spinous rays—the dorsal and anal being single.

Acanthoptery'gian (Gr. *akantha*, a spine or prickle, and *pterygion*, a winglet or fin).—A term applied to fishes having the back or dorsal fin composed of spiny rays, as the perch, gurnard, &c. The *Acanthopterygii* constitute one of Cuvier's orders of osseous fishes.

Acánthoteú'this (Gr. *akántha*, a thorn, and *teuthis* a cuttle-fish).—A genus of fossil cuttle-fishes occurring in oolitic strata, and so termed from the horny hooklets that arm their tentacles, which appear to have been ten

in number. These hooklets, the horny sucking-discs, and internal bones or osselets (belemnites), are generally the only portions preserved.

Acanticonite.—An all but obsolete synonyme for pistacite, a sub-species of prismatic augite spar or epidote, which see. Is said to derive its name from Gr. *akánthis*, a goldfinch, and *konis*, powder, because the colour of the powdered mineral resembles that of the plumes of the goldfinch.

Acáridæ or Acarea (Lat. *acárus*, a mite).—The Mite family (so called from the typical genus *acarus*), to which the mite, the tick, the water-mite, and other minute arachnidans belong. They are chiefly of geological interest from the experiments of Crosse, who imagined he could produce some species (*Acarus Crossei*, &c.) at will, by passing long-continued currents of electricity through certain siliceous solutions.

Accipensérídeæ (Lat. *accipenser*, the sturgeon).—The Sturgeon family, a well-known but limited group of ganoid fishes belonging to the sub-order Chondrostea or Loricata, and especially characterised by the almost total absence of an osseous vertebral column, and by the presence, in most species, of a strong dermal covering or exo-skeleton consisting of large bony tuberculated plates arranged in rows on the upper surface of the body, and shielding the head as if in solid piece. The existing sturgeons are chiefly of large size, and inhabit the sea, but ascend the larger rivers for the purpose of spawning: the fossil species seem to have been governed by a similar habit, and are found from the lower Tertiaries upwards.

Accíptres (Lat. *accipiter*, a hawk; from *accipere*, to seize).—The ornithological term for the rapacious birds, such as the eagles, falcons, hawks, &c., which seize their prey with their talons. There are two subdivisions, the diurnal and the nocturnal. Their remains occur, though very sparingly, from the lower Tertiaries upwards.

Acclimatise (Fr. *acclimater*).—To accustom a plant or animal to a climate not natural to it; to accustom to the temperature of a new region. Plants and animals may, within certain limits, become acclimatised, and flourish and increase in a new country, though not indigenous to it. **Acclimated.**—Accustomed to a climate.

Accrétion (Lat. *accretio*).—Increase by external addition of new matter; applied strictly to mineral or inorganic increase. Plants and animals grow by alimantation, or the *assimilation* of additional matter; minerals enlarge by *accretion*.

—**Aceous.**—Terminations in *aceous* denote resemblance to, or partaking of the qualities of, a substance, as *argillaceous*, less or more clayey; *carbonaceous*, partaking of the qualities or appearance of carbon; *saponaceous*, having a soapy feel.

Acéphala, Acéphalous (Gr. *a*, without, and *kephale*, the head).—Applied to those mollusca which, like the oyster and scallop, have no distinct head, in contradistinction from the *Encephalous*, or those with a distinct head. The division *Acephala* comprehends most of the bivalve molluscs, and several that are destitute of shells—in other words, the *brachiopoda*, *conchifera*, and *tunicata*.

Acéscent (Lat. *acesco*, to become sour).—Slightly acid; having a tendency to pass into an acid state; applied to substances which, like vegetable and animal juices, become sour spontaneously—that is, on exposure to the oxygen of the atmosphere.

Acetabulifera (Lat. *acetabulum*, a sucker, and *fero*, I bear).—Literally “sucker-bearers;” that section of the cephalopodous molluscs whose arms

or tentacles are furnished with rows of little cups or suckers, a characteristic peculiar to Neozoic genera.—See tabulations, "MOLLUSCA."

Acetábulum (Lat. a sucker).—Applied in zoology to such organs as the cup-like sucking-discs (*acetabula*) with which the arms of the cuttle-fish are provided. So far as yet known, the arms of the Palæozoic cephalopods were void of sucking-discs—organs abundantly common to Mesozoic and Neozoic genera.

Ächmite (Gr. *akme*, a sharp point).—One of the hornblende family occurring in the granites and syenites of Norway in long greenish-black prismatic crystals, which terminate very acutely; hence the name. It consists of 55.6 silica, 32 iron peroxide, and 12.4 soda.

Ächroite (Gr. *a*, without, and *chroa*, colour).—A term employed by Hermann to designate the colourless varieties of tourmaline, as distinguished from the dark-coloured varieties (*Schorl*), and from the red (*Rubellite*).

Äcicular (Lat. *acicula*, a little needle).—Mineral crystals occurring in slender needle-like prisms or prickles, as actynolite, are said to be *acicular*. Irregular aggregations of these slender prisms constitute the "acicular texture" of actynolite-rock and actynolite-slate.

Äcifulite (Lat. *acicula*, a needle).—Needle ore; a plumbo-cupreous sulphuret of bismuth occurring imbedded in quartz in long, thin, steel-grey crystals, strongly marked with vertical striae, and apparently in four or six-sided prisms. It consists of 35.8 lead, 11 copper, 36.7 bismuth, and 16.5 sulphur, and usually accompanies native gold.

Äcidéapis (Gr. *akis*, spear-point, and *aspis*, buckler).—A genus of trilobites, so named by Murchison from the central lobe of the head-plate or cephalic shield projecting over the body in the form of a pointed stomacher.

Äcidulous, Äcidulated.—Slightly acid or sub-acid. Applied to certain waters and springs that hold in solution a small percentage of sulphuric or other acid.

Äcinöse (Lat. *acinus*, a seed or germ).—Granulated; applied to mineral textures and surfaces which have a granulated appearance like the fruit of the raspberry.

Äcotylédonous (Gr. *a*, without, and *cotyledon*, seed-lobe).—Plants whose embryos have no seed-lobes or seminal leaves are so termed, in contradistinction to *Monocotyledons* and *Dicotyledons*.—See tabulations, "VEGETABLE SCHEME."

Äcrita (Gr. *akritos*, indistinct).—In some zoological classifications, a primary division of the animal kingdom, comprising the lowest classes of radiata, which are characterised by an *indistinct*, diffused, or molecular condition of the nervous system. The Äcrita constitute the *Protozoa*, the *Cryptozoa*, the *Oozoa*, and *Globular zoophytes* of other systematists.

Äcrocephalic (Gr. *akros*, raised to a point, high; and *kephale*, the head).—High-headed or pyramidal-headed; e.g., the pyramidal or high-skulled tribes of the human family.

Äcrodont (Gr. *akros*, the summit, and *odous*, tooth).—A term applied by Professor Owen to those squamate or loricated saurians whose teeth are anchylosed to the summit of the alveolar ridge.—See THEODONT.

Äcrodus (Gr. *akros*, the ridge, and *odous*, tooth).—Literally "ridge-tooth;" a genus of Cestracient fish-teeth occurring abundantly in the Oolitic and Chalk formations, and characterised by their enamelled surface being

covered with fine grooves and striae which diverge from a central longitudinal ridge. They are known to collectors as *fossil leeches*, from a fanciful resemblance to a contracted leech.

Acrogæous (Gr. *akros*, the top, and *ginomai*, I am formed).—Applied to those cryptogamic plants which increase by growth at the summit, or "growing-point," as the tree-ferns. Acrogens are therefore separated as a great botanical division from Thallogens, Endogens, and Exogens.—See tabulations, "VEGETABLE SCHEME."

Acrognáthus (Gr. *akros*, high, and *gnathos*, the jaw).—Literally "deep-jaw;" a genus of fishes from the Lower Chalk, and arranged by Agassiz under the *Salmonidae*, or Salmon-family.

Acrosaurus (Gr. *akros*, the point or summit, and *sauros*, lizard).—One of the extraordinary fossil reptiles discovered by Mr Bain in the supposed Triassic sandstones of South Africa. It has thirty or forty teeth on the alveolar ridge (hence the name), and a broad process of the cheekbone extending downwards over the side of the lower jaw.

Acteosaurus (Gr. *akte*, the sea-shore, and *sauros*, lizard).—A lacertian reptile of the Chalk period, with concavo-convex vertebrae, remarkably small extremities, and allied to *Dolichosaurus* (which see), but of considerably smaller dimensions. The genus was established by Von Meyer from a finely preserved specimen in the City Museum of Trieste, and so named from its having been found near the Istrian shore, and also from the belief that the creature when living had a littoral habitat.

Actinia (Gr. *aktin*, a ray).—The sea-anemone; so called from the ray-like arrangement of its tentacles, which surround the mouth like the petals of a flower. The *Actiniae* belong to the class *Polypi*, or true polypes, and from their structure are sometimes named "Fleshy Polypes." It has been suggested by Dr Mantell that some of the minute siliceous spicules so abundant in Chalk, and commonly ascribed to sponges, may have belonged to Actiniae, in whose structure such organisms also occur.

Actinócrinus, Actinócrinite (Gr. *aktin*, a ray or thorn).—A genus of encrinites found chiefly in the Carboniferous limestone, and distinguished by the thorn-like side-arms which project from the main column or stalk at irregular distances.—See ENCRINITE.

Actynolite, Actinóte (Gr. *aktinotos*, radiated, and *lithos*, stone).—A mineral occurring in the crystalline rocks, composed of radiating or thorn-like crystals of a dark or greenish hue, and in composition closely allied to hornblende; in fact, comprehends the glassy fibrous and granular varieties of that mineral.—Actynolite-rock and actynolite-schist are the common forms in which the mineral appears—the latter consisting of a basis of felspar with intermingled crystals of actynolite. According to Bonsdorf, specimens from Taberg consist of 59.75 silica, 21.10 magnesia, 14.25 lime, 3.95 protoxide of iron, with traces of manganese and fluoric acid.

Adámant (Gr. *adamas*, *adamantos*, unsubdued, strong).—An old term given to several minerals having the property of excessive hardness, as to the diamond. **Adamantine** and **Adamantean**.—Hard as adamant; excessively hard; having the lustre of diamond.

Adamántine Spar.—The diamond spar of Werner; a variety of corundum occurring in rough crystals, with very distinct cleavage, hair-brown colour, and adamantine lustre.

Adámic.—Of or pertaining to Adam; *Adamic earth*, an old term for common red clay, from the belief that the name "Adam" signifies red earth.

A'dapis (Gr. *a*, not, and *dapis*, a carpet).—Literally "no-carpet;" a name given in allusion to its rough or prickly skin. An extinct Tertiary pachyderm, somewhat resembling a hedgehog, but three times the size of that animal. It seems, according to Cuvier, to have formed a link connecting the *Pachyderms* with the *Insectivora*.

Adhesion (Lat. *ad*, and *hæro*, to stick together).—The force of cohesion acting between solid masses which come in contact at many points; the more intimate the contact the greater the force.

Adiantites (Gr. *adiantos*, of a dry nature, membranaceous).—A genus of fossil ferns found in the Coal-measures, and so termed from their resemblance to the existing *adiantum* or maiden-hair.

Adipocere (Lat. *adeps*, fat, and *cera*, wax).—A light, waxy, fatty substance, of a light-brown or whitish-grey colour, into which animal muscle is converted when buried in moist earth, or when subjected to long immersion in water. It is occasionally found in graveyards (hence "grave-wax"), in peat-bogs, and other similar situations; and is frequently cast up in lumps on the shores of tidal estuaries. It is chiefly *margarate of ammonia*, and is obviously generated by the reaction of the ammonia upon the margarine and oleine of the animal substances from which it is produced.

Adipocerite, or **Adipocere Mineral**.—A fatty unctuous matter found in certain peat-mosses (the "creasy clods" of the Scotch peat-digger); in connection with ironstone of the Coal-measures, as at Merthyr; and with sandstone strata, as at Binny in Linlithgowshire.

Adit (Lat. *aditus*, an approach or entrance).—An underground horizontal gallery or tunnel, generally opening from the lower level of a ravine or hill-side into a mine for the purpose of carrying off its waters, or for the purposes of entrance, and removal of the ores.

Adularia (Gr. *adularos*, sweetly-fair, in allusion to its soft lustre).—A transparent or translucent variety of potash felspar, known also as *icespar*, with splendid lustre, and either colourless and white, or slightly tinged with grey, green, or yellowish-brown. Specimens with a bluish opalescence are termed *Moonstones*, which see.

Æchmodus (Gr. *aichme*, a point, and *odus*, tooth).—A genus of ganoid fishes belonging to the Lepidoid family, and so named from their small, sharp-pointed teeth. They are almost exclusively confined to the Lias formation, and are readily distinguished by their deeply oval contour—their bodies being about as deep as long, and covered with transversely-arranged four-cornered oblong scales. Formerly ranked under the genus *tetragonolepis*, or "four-cornered scale."

Æpyornis, **Æpiornis** (Gr. *aiyus*, immense, and *ornis*, bird).—An extinct cursorial bird of gigantic dimensions, the eggs and a few scattered bones of which have been discovered in the alluvial deposits of Madagascar. The egg has six times the capacity of that of the ostrich; but judging from the large size of the egg of the New Zealand *Apteryx*, Professor Owen does not believe that the *Æpiornis* exceeded, if indeed it equalled, the *Dinornis* in stature. The bones would seem to indicate a bird at least double the size of the ostrich; and from their recentness, it appears not improbable that the creature may still be in existence in the interior of the island, which is almost unknown to Europeans.

Aërial (Gr. *aër*, the air).—Of or belonging to the air or atmosphere; frequenting the air; growing in the air. **Sub-aërial**.—Taking place under

the air, or on the earth's surface, in contradistinction to *Sub-aqueous*, or under the water.

Aëriform (Lat. *aër*, the air, and *forma*).—Air-like; applied to gaseous fluids, from their resemblance to common air; hence we hear of solid, liquid, and aëriform bodies.

Aerolite (Gr. *aër*, air, and *lithos*, stone).—Literally air-stone; a meteoric stone or mineral mass, which falls through the air, emitting light in its passage as if red hot, generally accompanied with a hissing or crackling sound, and occasionally with a report like thunder. Aerolites are by no means uncommon; and according to Schörobers, the greater number of them have always the same general form, which is that of an oblique or slanting pyramid; and they are also alike in external appearance, presenting to view a black shining crust, as if the body had been coated with pitch. This crust or film is extremely thin, and is of the same composition with the mass, which, when broken, displays a semi-metallic ash-grey colour. So like are they to one another in colour and in external appearance, that Berzelius remarks, "We might believe them to have been struck out of one piece." In composition they are also remarkable for containing *malleable metallic iron*, *nickel*, and *chrome*—metals which, in a native state, are rarely if ever found in terrestrial substances. Besides these ingredients, they contain upwards of a dozen others (silica, magnesia potash, cobalt, &c.); and their specific gravities range from 3.35 to 4.23. These common characteristics seem to indicate a common origin, and many ingenious arguments have been advanced to prove that they are not of terrestrial production. This is not the place to enter upon such speculations, but we may indicate briefly the leading hypotheses that have been advanced to account for the origin of these extraordinary bodies, which cannot in the mean time be associated with any known terrestrial minerals. It has been supposed—1st, That they are ejected from terrestrial volcanoes; 2d, That they are produced in the atmosphere, being generated from vapours exhaled from the earth, and containing volatilised metallic products; 3d, That they are thrown from lunar volcanoes; and 4th, That they are celestial bodies, revolving either about the earth or the sun, in the manner of planets, and being involved in the earth's influences are carried downwards by the force of gravitation.—See METEORITE.

Ærugo (Lat. *as*, *aris*, copper).—Literally copper-rust; verdigris; a sub-acetate of copper formed by the action of weak acids on its surface, as that produced naturally by the oxygen and carbonic acid of the atmosphere.

Estuary.—See ESTUARY.

Ethiops (Gr. *aitho*, I burn, and *ops*, the eye or countenance).—Applied to various chemical compounds in allusion to their black appearance, resembling that of the Ethiop. Thus we have *Ethiops mineral*, the black sulphuret of mercury; *Ethiops per se*, the grey oxide of mercury, &c.

Ætites or **Ætites Lapis** (Gr. *ætos*, an eagle).—A variety of nodular iron-stone or *geode*, consisting of concentric layers, and either hollow or containing a loose central core.—Is said to derive its name from a popular notion that it was found in eagles' nests, where it was supposed to prevent the eggs from becoming rotten.—See EAGLE-STONE.

Affinity (Lat. *affinis*, neighbouring, bordering on, related to).—A term frequently, but often very loosely, used by writers on natural history. "Affinity," as first defined by Macleay in contradistinction from "analogy,"

signifies the relationship which one animal bears to another in its structure, and is the closer as the similarity of structure is greater. Swainson illustrates this idea by comparing a goatsucker with a swallow and with a bat: with the one its relation is *intimate*, with the other *remote*; the goatsucker has affinity with the swallow, inasmuch as the structural organisation of the one bird is intimately related to the other; but it has only "analogy" to the bat, inasmuch as bird and mammal, though differing in structure, have the common function of feeding in the same manner on insects, and flying at the same hour of the day.—See ANALOGY and HOMOLOGUE.

Affluent (Lat. *ad*, to, and *fluens*, flowing).—Applied to any stream that flows directly into another—the larger or more important being regarded as the *recipient*, and the smaller the *affluent*.—See TRIBUTARY.

After-Damp.—Another name for "choke-damp," or carbonic acid, as occurring in coal mines *after* an explosion of "fire-damp," or light caruretted hydrogen.

Agalmátolite.—(Gr. *agalma*, an image, and *lithos*, stone).—A variety of altered clay or clay-slate (a silicate of alumina with potash), usually brought from China, and so called from its being carved into images and other figures.—See FIGURE-STONE and PAGODITE.

Agáric Mineral (Lat. *agaricus*, a species of fungus).—A soft variety of carbonate of lime found in clefts and on other surfaces of rocks, in light and loosely-cohering incrustations. It is so light as to float for a time on water, and obtains its name from its resemblance to a fungus in texture and colour.

Agate (said to be from the river *Achates* in Sicily, where fine varieties occur, and by others from the Phœnician word *nakadt*, signifying spotted).—A mixed, siliceous, semi-pellucid mineral usually found in veins, in nodules, and in geodes within igneous rocks. The geodes often consist of alternating bands or deposits of carnelian, calcedony, jasper, opal, quartz, &c.; hence the varieties of the mineral are known by such names as ribbon-agate, fortification-agate, brecciated agate, moss-agate, and the like. When cut and polished, the ribbon-agates exhibit the calcedony, jasper, quartz, &c., in parallel stripes; the fortification-agates show the alternating bands in zigzag arrangements like the plan of a modern fortification; the brecciated consist of irregular fragments of the two former imbedded in a matrix of amethyst; and the moss-agates exhibit minute dendritic ramifications resembling fragments of moss, confervæ, &c.; hence their respective names. The finer varieties of agate are termed *oriental*; the Arabian moss-agates are known to the jeweller as *mocha-stones*; and the most beautiful British varieties, being found in the traps of Scotland, are termed *Scotch pebbles*. The colouring matter of agates being due to metallic oxides, factitious colours of greater intensity can be produced by heat or by boiling in various chemical solutions.

Agglomerate.—A term employed by Sir Charles Lyell to designate those accumulations of *angular* fragments of rock which are thrown up by volcanic eruptions, and showered to greater or less distances around the cone or orator of eruption. When they are carried to a distance by running water, and get worn and rounded, they become *conglomerates*.

Agnóstus (Gr. *agnostos*, unknown, obscure).—A genus of minute trilobites supposed to be characteristic of, and peculiar to, the lowest Silurian zones. Little, however, is known of them either as to their zoological characteristics or geological distribution.

Aiguille (Fr.)—A needle; applied in physical geography and geology to the sharp serrated peaks of lofty mountains. It is generally the crystalline rocks, such as gneiss, quartz, and the like, which weather into the *aiguille* or needle-top.

Air-course.—In coal-mining, a general name for the air-traversing workings where ventilation is going on. The fresh air descending into the mine is termed the "*intake*;" and that which ascends after having passed through the workings is the "*return*."

Aix, Aix Beds.—A town in Provence, situated in a deep valley, the immediate flanks of which are composed of a thick fresh-water Tertiary formation, consisting of greyish-white calcareous marls, calcareo-siliceous grits, and beds of gypsum; the whole being a perfect storehouse of fossil fishes, plants, and insects.

Akumite Series (Gr. *akmos*, tranquil).—According to Dr Fleming ('Lithology of Edinburgh'), the modern epoch, from the commencement of the Boulder-clay upwards, may be divided into three series—viz., the *Taragmite*, the *Akumite*, and the *Phanerite*. The first embraces the Boulder-drift, or period of *disturbance*; the second, those laminated clays and sands which immediately overlie the Boulder-clay, and seem to indicate the assorting power of water under circumstances of comparative *tranquillity*; and the third, all those more superficial deposits whose modes and causes of formation are sufficiently *evident*.—See MODERN or POST-TERTIARY EPOCH.

Alabandine.—Sulphuret of manganese or hexahedral glance-blende. It occurs crystalline, but usually massive, granular, and disseminated, of an iron-black colour and semi-metallic lustre. It is found in veins with foliated tellurium, blende, and quartz, in Saxony, Mexico, and Brazil; and consists of 6.36 manganese, and 36.4 sulphur.

Alabaster (Gr. *alabastron*).—There are two well-known varieties of this marble-like mineral—the gypseous and the calcareous. The former is a semi-transparent, granular-crystalline variety of gypsum, or *sulphate* of lime, of various colours, but most esteemed when of a pure snow-white, and usually compact enough to stand the turning-lathe; the latter is a *carbonate* of lime (Oriental alabaster), usually white or yellowish-white, and found as a stalactite or stalagmite. Alabaster is a mineral of common occurrence in Secondary and Tertiary formations (Cheshire, Montmartre near Paris, Volterra in Tuscany, &c.); and being soft and readily turned by the lathe, is manufactured into statuettes, vases, and other domestic ornaments; hence, perhaps, the term *alabastron*, an ink or perfume vase. Others derive it from *Alabastron*, a town in Egypt famous for the manufacture of such vases.—See GYPSUM.

Albani Stone (Lat. *lapis albanus*).—The *peperino* of the Italians; a well-known volcanic rock, much used at Rome before building with marble became common.—See PEPERINO.

Albert Coal, Albertite.—The name given to a bituminous mineral occurring at Hillsboro', Albert County, in the province of New Brunswick, and within four miles of the Peticodiac river. It is an injected vein, cutting the associated strata almost vertically, and from one to sixteen feet in thickness. The accompanying rocks are highly charged with bitumen; but the vein, though called a "coal," has none of the stratigraphical characteristics or accompaniments that distinguish coal deposits. The mineral is extremely brilliant, breaks with a conchoidal fracture, does not soil the fingers, and is strongly electric. It melts and drops in the flame of a

candle, and dissolves in naphtha and other solvents, forming a varnish. It has all the essential properties of asphalt, while it is void of those which constitute true coal. According to Gesner its composition is—carbon 85.4, hydrogen 9.2, nitrogen 3.0, sulphur a trace, oxygen 2.2, and ash 12. Known also as *Melanasphalt*, which see.

Albite (Lat. *alba*, white).—A variety of felspar of a greyish-white or milky-white colour, composed of silic 70.5, alumina 19.5, soda 9.5, and traces of lime and manganese. It is a frequent constituent of granites, syenites, and greenstones, and is known also as *Cleavandite* and *soda felspar*.

Album Græcum.—The whitish hardened excrement of dogs, wolves, hyenas, and other carnivora partially feeding on bones. It consists of the earth-of-bones or lime, in combination with phosphoric acid. Dr Buckland (*Reliq. Diluv.*, &c.) detected the substance in a fossil state in ossiferous caverns, such as those of Kirkdale and Kent's Hole, which are therefore concluded to have been the dens of Tertiary carnivora. More recently, Dr Falconer has found it abundantly in the bone-caves near Palermo, and indicative of animals of greater size than any of the existing hyenas.

Alcyonite.—A general term for the spongy fossils so common in the Chalk formation. They are fossil *alcyonia*, and very frequently form the basis or organic nucleus round which flints have collected. It has also been surmised by Dr Mantell that some of the minute siliceous spicules so common in the Chalk may have belonged to alcyonia.

Aléthopteris (Gr. *alethos*, true; *ptéris*, fern).—One of Sternberg's genera of fossil ferns, closely allied to *pecopteris*, and merged by Lindley into that genus. It abounds particularly in the lower Coal formation, but some of the species range up through the Oolite and Wealden.—See *PECOPTERIS*.

Alga (Lat. *alga*, sea-weed).—Cellular aquatic plants, mostly of marine habitat, though many genera are strictly fluviatile or lacustrine. They are found fossil, less or more, in every formation from the Silurian upwards: and are known by such terms as *fucites*, *chondrites*, *palæochorda*, &c., from their resemblance to the living *fucus*, *chondrus*, *chorda*, &c.

Algódomite.—A new mineral, consisting of copper 83.30, and arsenic 16.23, with a trace of silver; found in the silver mines of Algodés, near Coquimbo, in Chili—whence the name.

Alkalies (Arabic, *al*, the, and *kali*, the name of a plant yielding the alkali).—In chemistry, a class of bodies which possess a strong acrid and caustic taste; exercise a corrosive action upon all animal matter; turn vegetable blues *green*, and vegetable yellows *brown*, and which naturalise the acids by combining with them in definite proportions, and forming compounds called *salts*. The principal mineral alkalies are potass, soda, lithia, and ammonia.

Alkaline Earths.—A term applied to *baryta*, *lime*, *magnesia*, and *strontia*, in consequence of their possessing alkaline properties, as causticity, action on vegetable colours, and the like.

Allanite.—A silico-aluminate of cerium, containing varying proportions of iron, lime, and magnesia, &c. It is named after the late Mr Allan, of Edinburgh, and is closely allied to, if not identical with, the *cerine* and *orthite* of other mineralogists.

Alligator.—The generic term for the crocodilians of the American continent, which have a broad, obtuse snout, and the canine teeth of the lower jaw received into a pit of the upper. Remains of closely allied forms have

been found in the Tertiaries of Europe; e.g., *A. Hantoniensis*, from the Eocene beds of the Hampshire basin.

Allôchroite (Gr. *allos*, different, and *chroa*, colour).—A fine-grained, massive variety of iron-garnet, so called from the colours it exhibits when melted with phosphate of soda before the blowpipe.

Allophane (Gr. *allos*, different, and *phaino*, I appear).—One of the clay family, consisting essentially of silica, alumina, and water of crystallisation. It occurs in translucent, reniform, or encrusting masses, of a pale blue, white, green, or brown colour; lustre resinous, and very brittle.

Allôtrophy, Allotropic (Gr. *allotrôpos*, turning otherwise, of a different nature).—A term employed by Berzelius to denote the fact that the same body may exist in more than one usual condition, and have different physical characteristics. Carbon is a good example of this condition, as it crystallises perfectly in the diamond, imperfectly in graphite, and is amorphous and quite distinct in anthracite and coal.

Alloy (Fr. *aloi*, mixture of one metal with another).—A natural or artificial compound of one or more metals; as *brass*, an alloy of copper and zinc; *bell-metal*, a compound of copper and tin; *bronze*, an alloy of copper and tin; *type-metal*, an alloy of lead and antimony.

Alluvium, Alluvial (Lat. *luere*, to wash, and *ad*, together).—Matter washed or brought together by the ordinary operations of water is said to be *alluvial*, and the soil or land so formed is spoken of as *alluvium*. The soil of most of our river-plains (the "straths" and "carse" of Scotland, and the "dales" and "holmes" and "fens" of England) is chiefly of alluvial formation; these low grounds having once been the sites of lakes, estuaries, and shallow arms of the sea. All mud-deposits, as silt, warp, and the like, when converted into dry land, constitute alluvium.—See DILUVIUM.

Almandine.—A lapidary's term for the violet or violet-red varieties of the spinel-ruby; for the noble garnet, which is also of a columbine red approaching to violet; and for the pyrope or "Elie ruby," which see.

Alpine.—Pertaining to the Alps, or to any lofty mountain-range; applied to plants and animals whose natural stations and habitats are the higher zones of lofty mountains like the Alps.

Alstonite.—The *baryto-calcite* of Johnston, a carbonate of baryta and lime, so called from occurring in the lead mines of Alston Moor, in Cumberland.—See BARYTO-CALCITE.

Altaite.—Hexahedral tellurium; a metallic ore occurring massive in granular aggregates of a yellowish-white colour, and consisting of 60.35 lead, 1.28 silver, and 38.37 tellurium. It is found mixed with tellur-silver in the Sawodinski mine in the Altai mountains; hence the name.

Alternate Generation.—A mode of reproduction, not unfrequent among the radiata, in which the young do not resemble the immediate parent form but that of the grand-parent. The species is thus maintained by an alternating series of generations.

Alum (Lat. *alumen*, Gr. *als*, *alos*, salt).—Alum is a double salt, the sulphate of alumina and potash, the crystals of which contain nearly 50 per cent of water. Mineralogists mention several varieties, differing slightly in external and other characters, according as one isomorphous element is replaced by another, as *potash-alum* (34 sulphuric acid, 18 alumina, 10 potash, and 46 water), *soda-alum*, *ammonia-alum*, *magnesia-alum*, and *iron* or *feather alum*. The alum of commerce is chiefly manufactured from certain transition slates (Norway), from coal shales (Lanarkshire, &c.),

lias shales (Yorkshire), from lignite shales (Germany), and it occurs also in the volcanic formations of Sicily, &c.; hence the geological terms *aluminate*, *alum-shale*, *aluminite*, *alum-stone*, &c. Rocks containing alum in notable proportion generally manifest its presence, when exposed to air and moisture, by emitting whitish or yellowish-white efflorescences of the salt; and these as well as the water which trickles from the rocks are readily detected by their strong styptic taste.

Alúmina.—The pure plastic principle of clay, which is usually a silicate of alumina. Alumina is, in fact, an oxide of the metal aluminium, consisting of aluminium 12, and oxygen 8. Alumina is rarely found in a pure state in nature, and occurs chiefly as the basis of the clays, boles, loams, and other argillaceous earths. In its pure crystallised state it constitutes the sapphire, corundum, and other of our hardest gems.

Alúminite.—The mineralogical term for the native hydrated sub-sulphate of alumina, which generally occurs in roundish or reniform masses of a white or yellowish-white colour.

Alúminum, Aluminum, or Alúmium.—The metallic base of alumina; as *calcium* is the metallic base of lime, or *sodium* of soda. As a metal it is now being prepared to some extent, in France and England, from the *Cryolite* of Greenland; and from its lightness and brilliant white colour has been employed, though as yet with very indifferent success, as a substitute for silver. One of its most important applications is the manufacture of a *bronze*, consisting of from 90 to 95 of copper, and from 10 to 15 of aluminium. This bronze is extremely hard and tenacious, and bars of it may be worked hot as easily as the best quality of steel.

Alúnite (Fr. *alun*, alum).—Alumstone; occurring in minute rhombohedral crystals, but very frequently in fine, granular, earthy, or compact masses, intimately mixed with quartz or felspar. The mineral in its purity consists of about 37 alumina, 39 sulphuric acid, 11 potash, and 13 water; but the compact rock varies largely in its proportions of silica, some kinds being so silicious as to be suitable for millstones. It is found in Hungary, the Greek Isles, and in many parts of Italy—the *Roman alun*, valued on account of its purity, being chiefly obtained from this mineral by repeated roasting and lixivation. "In volcanic regions," says Nicol, "it is often formed by the action of sulphurous vapours on trachyte, and in other felspar rocks by the decomposition of iron-pyrites."

Alúnogene (*alun*, alum, and *ginomai*, I produce).—A sulphate of alumina, known also as *hair-salt* or *feather-alum*. It occurs in fine capillary fibres forming crusts, and irregular botryoidal masses; has a silky lustre, yellowish-white colour; tastes like alum; and consists of 36.05 sulphuric acid, 15.40 alumina, and 48.55 water. It seems to be, for the most part, a product of chemical changes now in progress; often forms in volcanic solfataras, or in clays, and felspar rocks containing pyrites; and is a frequent efflorescence on the walls of quarries and mines.

Alvéolus (Lat.).—A little trough or hollow channel; applied variously in natural history, as the *alveolus* or conical chamber of the belemnite.

Alveolites.—A genus of corals composed of concentrically arranged tables of short tubes, externally angular, and rounded within.

Amálgam.—A compound of mercury with other metals is termed an *amalgam*; the union of any other metal with another, an *alloy*. Some derive the term from the Greek *ama*, together, and *gameo*, I wed; others with more probability from *malagma*, a poultice or paste (from *malasso*, I

soften), in reference to the pasty nature of the admixture. A native amalgam (of 36 silver and 64 mercury) occurs in the mines of Sweden, Hungary, Spain, and South America, in fine silver-white plates, crusts, and arborescent forms; and in America another, under the name of *arquerite*, is worked as an ore of silver.

Amalgamation.—The process of making an amalgam of mercury with some other metal, for the purpose of separating the silver and gold they may contain. This operation is founded on the property which mercury possesses of dissolving these metals out of the minerals with which they are associated.

Amazon-Stone.—A variety of common felspar coloured green by the oxide of copper, and so named from its occurring in rolled masses near the river Amazon.—See **AXE-STONE**.

Amber (Arabic).—A well-known fossil gum or gum-resin, usually found in connection with Tertiary lignites. It is hard, rather brittle, easily cut, of various shades of yellow, and semi-transparent. It is very light, becomes negatively electric by friction, and burns, like other hydro-carbons, with much smoke and flame. It consists of about 70 carbon, 12 hydrogen, and 8 oxygen; and frequently encloses chips of leaves, insects, and the like—showing that it must once have been in the state of a gummy or viscous exudation. It occurs in irregular nodules, from the size of a hazel-nut to that of a man's head, the latter size, however, being very rare. It is found in Sicily, Poland, Saxony, Siberia, and Greenland, in Tertiary clays; on the Yorkshire coast of our own country; but in particular on the Baltic coast of East Prussia, where it is thrown up after storms, and strewn like pebbles along the shore. It is also, but very seldom, obtained by digging down to the looser beds of the Tertiary lignites in Northern Germany; and there it appears in connection with coniferous trunks and branches. These forests of Amber Pines (*Pinites succinifer*) seem to have been situated in the south-eastern part of what is now the bed of the Baltic (about 55° N. lat., and 37° to 38° E. long.), and were probably destroyed at the commencement of the Drift period.

Ambergris (Fr. *Grey-amber*, in allusion to its amber-like character).—An odorous solid substance, supposed by some to be a morbid secretion from the liver or intestines of the spermaceti whale, analogous to the biliary calculi; and by others, to be merely the indurated fæces of the animal, perhaps somewhat altered by disease. It is usually found floating or cast on shore, in irregular lumps. No analogous fossil substance is yet known to geologists.

Amblygonite (Gr. *amblygonios*, having an obtuse angle).—A phosphate of alumina and lithia occurring in granitic rocks, either massive or in oblique rhombic prisms, which are rough externally and of a greenish-white or sea-green colour; translucent; with a vitreous lustre inclining to pearly.

Amblypterus (Gr. *amblys*, blunt, and *pteron*, fin).—Literally “blunt or broad fin;” a genus of ganoid fishes belonging to the Lepidoid family, occurring in the Carboniferous formation, and characterised, as the name implies, by their very large and wide fins, composed of numerous rays. Scales rhomboidal and highly enamelled; tail boldly heterocercue.

Amblyurus (Gr. *amblys*, blunt, and *oura*, a tail).—Literally “blunt or broad tail;” a genus of Lepidoid fishes, found fossil in the Lias formation, and so named from the full development of the caudal fin.

Ambulácrá (Lat. *ambulacrum*, an avenue or walking-place).—The perforated series of plates in the crust of the sea-urchins, through which the walking-feet are protruded, and which form marked bands or zones on the exterior when the crust is denuded of its spines. **Ambulacral**.—Applied to these plates in contradistinction to the imperforate or *interambulacral* ones.

Amethyst.—Quartz or rock-crystal, coloured by a minute portion of iron and manganese. The amethyst is a transparent gem of a purple or violet-blue colour; it is sometimes naturally colourless, and may at any time be deprived of its colour by the action of heat. Some derive the name from its colour, which resembles wine mixed with water; while others think it obtained its name (Gr. *a*, priv., and *methystes*, drunkard), from its supposed virtue of preventing intoxication, and hence worn by topers as an amulet. **Amethystine**.—Possessing the properties of an amethyst; having that violet-blue tinge or colour peculiar to the amethyst, as "Amethystine Quartz."

Amethystoline.—The name given to the volatile fluid observed by Sir David Brewster in the minute cavities of amethyst.

Amianthinite.—A massive variety of actinolite, of a yellowish-grey or ash colour, and having a confusedly foliated and fibrous fracture, whence the name.

Amiánthus (Gr. *a*, priv., and *miaino*, to soil).—This term, though often used as synonymous with *asbestos*, properly includes only the varieties which occur in delicate and regular silky fibres. The name is said to be derived from the incombustible nature of the mineral, which, when woven into cloth, admits of being cleansed by being thrown into the fire. That small fancy fabrics can be manufactured of amianthus is well known: it was occasionally so employed by the ancients, and is still used for that purpose in Siberia, Italy, and the Pyrenees. It is also employed as incombustible lamp-wicks; for filling gas-grates—the fibres remaining red-hot without being consumed; and attempts have been made to manufacture it into an incombustible paper. Amianthus is found abundantly in many countries, particularly in primitive districts; and occurs in veins in which the filaments or fibres are perpendicular to the surfaces of the vein, and of various lengths, according to the thickness of the vein, which is sometimes, though rarely, a foot. Like the Hornblendes, to which it belongs, it consists chiefly of silica (58), magnesia (25), lime (12), with traces of alumina, iron, manganese, and water.—See ASBESTOS. **Amianthiform** and **Amianthoid**.—Having the form or likeness of amianthus.

Ammité (Gr. *ammos*, sand).—An old mineralogical term for roestone or oolite, and indeed for all those sandstones composed of rounded and loosely compacted grains like oolite.

Ammónia.—A transparent pungent gas, formed by the union of nitrogen and hydrogen, and named from *sal-ammoniac* (muriate of ammonia), of which it forms the basis. Ammonia is of geological interest, as being one of the products given off by active volcanoes.—See SAL-AMMONIAC.

Ammonite.—The fossil shell of a numerous and varied genus of cephalopodous mollusca, coiled in a plane spiral, and chambered within like the existing nautilus; so called from the resemblance of the shell to the horns on the statue of Jupiter Ammon. "Cornu Ammonis," "Whitby snakes," and "snakestones," are obsolete synonyms.—See AMMONITIDÆ. In the ammonites proper, the shell is discoidal; inner whorls more or less concealed; septa undulated; sutures lobed and foliated; siphuncle dorsal.

AMM — AMP

The range of the genus is from the Trias to the Chalk inclusive; and already upwards of 500 species have been described. These have been arranged by palaeontologists (Von Buch and D'Orbigny) into *six* sections, according as the back of the shell is keeled, crenated, sharp, channeled, squared, or round and convex; and these sections have been again divided into *fifteen* groups, according to form, armature, sutures, or other peculiarity. They are as follows:—

1. <i>Arietes</i> .	}	Back keeled.
2. <i>Falciiferi</i> .		
3. <i>Cristati</i> .		
4. <i>Amalthei</i> .		
5. <i>Rhynchomagensis</i> .	}	Back crenated.
6. <i>Disci</i> .		
7. <i>Dentati</i> .	}	Back sharp.
8. <i>Armati</i> .		
9. <i>Capricorni</i> .	}	Back squared.
10. <i>Ornati</i> .		
11. <i>Heterophylli</i> .		
12. <i>Ligati</i> .	}	Back round, convex.
13. <i>Annulati</i> .		
14. <i>Coronati</i> .		
15. <i>Fimbriati</i> .		

Figures of these types or groups are given by D'Orbigny, and on the Palaeontological Map of the British Islands in Johnston's 'Physical Atlas.'

Ammonitidæ.—A numerous extinct family of tetrabranchiate cephalopods of which the well-known ammonite is the type. The family ranges from the Devonian to the Chalk inclusive, becoming extremely abundant and varied in form in the upper Secondary formations. It includes the *goniatites*, *bacrites*, *ceratites*, *ammonites* proper, *criocerites*, *toxocerites*, *ancylocerites*, *scaphites*, *heliocerites*, *turritiles*, *hamites*, *ptychocerites*, and *vacuities*, which see. In the Ammonitidæ the shell is external and many-chambered; body-chamber elongated; aperture guarded by processes, and closed by an operculum; sutures angulated, lobed, or foliated; siphuncle external (or dorsal as regards the shell). The shell has essentially the same structure as that of the nautilus—a porcellaneous layer externally, and a nacreous lining internally. In some species of ammonite the shell is armed with prominent spines or tubercles; and in others the outer margin is furnished with curious projecting processes. The Ammonitidæ, in one or other of their genera, are perhaps the most remarkable of Secondary mollusca.—See CEPHALOPODA.

Amorphous (Gr. *a*, without, and *morphe*, form).—Applied in geology and mineralogy to rock-masses and minerals that have no regular or determinate structure, in contradistinction from those which, like basalt and rock-crystal, always appear in some definite form. Void of structure; massive.

Amorphozoa (Gr. *a*, without; *morphe*, form; and *zoon*, an animal).—The lowest class of the animal kingdom, containing the sponges and their allies; so called from their want of regular symmetrical structure. Fossil remains of this class occur in notable abundance in the Chalk formation.

Ampelites (Gr. *ampelos*, the vine).—A term used by Brongniart for aluminates, which occurs both in the metamorphic and fossiliferous series.

Amphl.—A Greek prepositional prefix signifying about, on both sides, near to, or concerning; and frequently used to imply doubt as to which of

two sides, or to which of two things, the object in question belongs; as *amphibious*, capable of living either in the water or on land.

Amphibia (Gr. *amphi*, both, and *bios*, life).—Applied to animals capable of living either in water or on land; but in zoology more strictly to those batrachians or frog-like reptiles—the axolotls, menobranchi, sirens, and proteus—which have both lungs and gills, and consequently adapted for life in either element.

Amphibichnites (*amphibia*, animals capable of living on land or in water, and *ichnon*, a footprint).—The generic term for fossil footprints that seem to have been impressed by the feet of amphibious reptiles as they passed over the soft yielding beach to and from the waters.

Amphibolé and **Amphibolite**.—The names usually given by French geologists to *Hornblende* and *Hornblende Rock*, which see. The terms are derived from the Greek *amphibolos*, ambiguous or equivocal, in allusion to the difficulty of distinguishing hornblende from augite, which is similarly constituted.

Amphicyon (Gr. *amphi*, implying doubt, and *kion*, dog).—A large carnivorous quadruped, found principally in miocene Tertiaries, and so termed from its intermediate position between the digitigrade and plantigrade families, as indicated by its tuberculated molars or carnassial teeth.

Amphigens (Gr. *amphi*, all around, and *ginomai*, I am formed).—Plants which increase by the growth or development of their cellular tissue on all sides, as the lichens.—See tabulations, "VEGETABLE SCHEME."

Amphiléstes (Gr. *amphi*, implying doubt, and *lestes*, beast of prey).—A small quadruped of doubtful relationship, only the lower jaw of which has yet been found in the Stonesfield oolite, Oxfordshire. From the structure of its teeth—the molars having three cusps, the large middle one of which has two small accessory tubercles or cuspules—it is supposed to be an insectivorous marsupial, allied perhaps to *amphitherium*.

Amphipeltis (Gr. *amphi*, doubtful, and *peltis*, provided with a shield or buckler).—A provisional genus of small crustaceans from the Devonian rocks of Nova Scotia, and so called from the doubtful affinity of its fragmentary carapace and segments to any existing order. Apparently allied to the phyllopods.

Amphistegina (Gr. *amphi*, on both sides, and *stega*, a roof).—A genus of foraminiferous shells, occurring abundantly in the Tertiary basin of Vienna, and so termed from the flatly conical or roof-like aspect both of its upper and under surface. According to D'Archiac, it takes the same place among the foraminifera of the Miocene era which the nummulites occupy in the Eocene period.

Amphithérium (Gr. *amphi*, implying doubt, and *therion*, wild beast).—An insectivorous mammal of the Oolitic epoch, whose teeth and jawbones have been found in the Stonesfield slate of Oxfordshire. The doubt that hangs over the true affinities of these remains (whether marsupial or placental) has necessitated the provisional name of *amphitherium*.

Amphorácrinus (Lat. *amphora*, a cup or goblet).—A genus or rather sub-genus of Carboniferous crinoids, chiefly distinguished by the arrangement of their radial plates. The "cup" or body of this genus is small and shallow as in *actinocrinus*, to which it is closely related.

Amygdaloid (Gr. *amygdalon*, an almond, and *eidos*, appearance).—This term is applied to certain igneous rocks containing small almond-shaped vesicular cavities, either partially or entirely filled with agate, jasper, calc-

spar, and other minerals. These minerals being of a different colour from the mass of the rock in which they are imbedded, look like almonds in a cake; hence the terms *amygdaloid* and *amygdaloidal*. The amygdaloids—as “amygdaloidal trap-tuff,” “amygdaloidal wackè,” &c.—are especially abundant in the Trap series, and many of them seem to have originally been open vesicular lavas, through which water charged with siliceous and calcareous solutions had percolated for ages, until, finally filling up the cavities with the agates, calc-spars, &c., already alluded to, they became the amygdaloids in question.

Anádromous (Gr. *ana*, upwards, and *dromos*, a flight or running).—Literally “running up;” applied in zoology to aquatic animals which, like the salmon and sturgeon, periodically forsake the waters of the ocean and ascend into fresh-water lakes and rivers for the purpose of spawning. Fishes are thus spoken of as *marine*, *fresh-water*, and *anadromous*,—the two former never quitting their native elements, and incapable of subsisting in any other, and the latter possessing the power and habit already alluded to.

Anal (Lat. *anus*).—Pertaining to or situated near the anus,—as the *anal* fin. The *anal* fin in fishes is that which is placed between the vent and tail, and expands vertically downwards.

Analcime (Gr. *a*, without, and *alkimos*, strong).—A zeolitic mineral found abundantly in trappean rocks, and so named by Haily on account of its feebly electric properties. A specimen from Kilpatrick Hills consisted (according to Connel) of silica 55.07, alumina 22.23, soda 13.71, potash and lime a trace, and water 8.22.

Analogue (Gr. *ana*, with, and *logos*, reasoning).—An object that has a resemblance to, or correspondence with, another. “Analogue” has reference to *similarity of function*; “homologue” to *identity of parts*. Thus, the wing of a bird and the dermal expansion of a bat are analogues, because they each enable their respective possessors to fly or sustain themselves in the air; but the wing-bones of the bird and the arm-bones of the quadruped are homologues, being anatomically identical. *Analogue* and *homologue* (which see), and *analogous* and *homologous*, are contradistinguishing terms.

Analogy (Gr. *ana*, with, and *logos*, reasoning).—That relationship, resemblance, or correspondence which one object bears to another in functional duty or performance. For the precise differences between *analogy*, *affinity*, and *homology*, see these terms.

Ananchytes.—A genus or subdivision of fossil sea-urchins belonging to the tribe *Spatangida*, and especially characteristic of the upper Chalk formation. They are readily distinguished by their elevated helmet-like form, by their simple ambulacra converging towards the summit, and by the transverse mouth and oblong outlet situated on the inferior face of the flat base, and towards the margin. Known in the south of England as “shepherd’s crowns,” and “fairy-loaves.”—See SPATANGIDÆ.

Anastomose (Gr. *ana*, and *stoma*, mouth).—To inosculate, to unite the mouth of one vessel with that of another, as the arteries with the veins; hence such vessels are said to be *anastomosing*, or running one into the other.

Anatase (Gr. *anatasís*, stretching forth).—Another name for *pyramidal titanium ore*, or *octedrite*, which is all but a pure oxide of titanium. Anatase is remarkable for its electrical properties; occurs in the granitic and crystalline rocks; of a dark indigo blue, hyacinth red, or yellowish-brown colour; and in elongated pyramidal crystals—whence the name.

Anchorage or Anchor-ground.—Any portion of a bay, estuary, channel, or arm of the sea, where the bottom is unimpeded by rocks, and the water of a suitable depth for ships riding at anchor.

Amcyloceras (Gr. *ankulos*, incurved ; *keras*, horn).—A genus of the Ammonitidae peculiar to the Oolite and Chalk, and so named from the singular shape of the shell, which is at first discoidal, with separate whorls, afterwards produced at a tangent, and bent back again like a hook or crozier.

Andalusite.—One of the garnet family, found chiefly imbedded in mica-schist, or in druses in other crystalline rocks, and so called from its being first discovered in Andalusia. It occurs for the most part in large prismatic crystals ; is always coloured, grey to green, flesh of peach-blossom red, violet blue or reddish-brown ; and consists of 40 silica and 60 alumina, with traces of iron, manganese, and lime.

Andesite.—The name given by Gustavus Rose to a trachyte of the Andes, which contains the felspar called *Andesine*, together with glassy felspar (orthoclase) and hornblende disseminated through a dark-coloured base.

Andrias.—The generic name given by Cuvier to the great aquatic Salamander, from the Miocene fresh-water beds of Oeningen, whose remains in 1700 were supposed to be human, and described by Scheuchzer as “*homo diluvii testis*.”

Anemometer (Gr. *anemos*, the wind, and *metron*, a measure).—An instrument for determining the direction and measuring the force and velocity of the winds, which see.

Aneroid (Gr.)—Literally without fluid. In the *aneroid barometer* the pressure of the atmosphere is measured by the elevation or depression of the surface of a closed metallic vessel partially exhausted of air. The pressure of the atmosphere being marked at a given time, any alteration is indicated by the movements of the surface of the thin corrugated metal, and communicated to wheels marking the change on a dial furnished with an index. Being easily carried about, the *aneroid* is extremely useful in enabling the geologist and traveller to approximate the relative heights of situations.

Angiosperms (Gr. *angeion*, a vessel, and *sperma*, seed).—Plants whose seeds are enclosed, or in seed-vessels, in contradistinction to *gymnosperms*.—See tabulations, “**VEGETABLE SCHEME**.”

Anhydrite (Gr. *a*, without, and *hydor*, water).—A transparent gypsum or sulphate of lime occurring in a crystalline form without water of crystallisation. Anhydrite occurs chiefly with rock salt and gypsum, or in the clays associated with these deposits. The fine crystalline varieties are known as *miracite*—the granular as *vulpinite* ; and all are much harder and heavier than ordinary gypsum, into which, however, they become converted by the slow absorption of water.

Anhydrous (Gr. *a*, without, and *hydor*, water).—Without water ; applied to minerals which do not contain water as an ingredient. Without water of crystallisation. The opposite of *Enhydrous*.

Animalcules (Lat., diminutive of animal).—A general term in zoology for exceedingly minute animals which cannot be studied without the assistance of the microscope. Speaking of the *fossil* animalcules of the Chalk, Dr Mantell remarks that “for the most part the microscopic shells in chalk and flint are filled with amorphous mineral matter ; but recent observations have shown that in numerous examples the shell contains the

body of the animal, in some instances silicified, but in others in the state of a dried animal substance like the ink-bag of the cuttle-fish in lias, the soft part of cephalopods in clay, and the capsule of the eye, and the membranes of the stomach of certain fishes in chalk."

Annéaling.—The process by which glass and porcelain are rendered less brittle, and by which the metals become tougher and more malleable. It is performed by placing the materials to be operated on in furnaces or ovens heated to a certain temperature, and then allowing them to cool gradually and slowly. During the process the molecular arrangement of the material undergoes a change analogous to what takes place in lava, which forms granular or glassy rocks according to the rapidity with which it is cooled—the quicker the process, the glassier and more brittle the product.

Annélida (Lat. *annellus*, a little ring).—Annelids. One of the classes of the animal kingdom having their bodies formed of a great number of small rings like the earth-worm, a double-ganglionated nervous cord, and red blood. They have been variously subdivided; but that arrangement which ranks them as *Errantia*, walking or swimming annelids, like the *nereis*; *Tubicola*, those which inhabit solid tubes, like the *serpula*; *Terricola*, those burrowing in the earth, as the earth-worm (*lumbricus*); and *Suctoria*, those furnished with a sucking cavity at each end, like the leech (*hirudo*), is perhaps the most intelligible. The casts, and tracks, and burrow-holes of annelids occur in all formations, *arenicolites*, *scolites*, &c.

Annulária (Lat. *annulus*, a ring).—A genus of fossil herbaceous plants with verticillate foliage like *asterophyllites*, but having the whorls arranged on the same plane with the stems on which they grew. It is supposed that they were aquatic plants, and that the stems and leaves floated on the surface of the water.

Annulosa (Lat. *annulus*, a ring).—A designation given by Macleay to the *Articulata*, in allusion to their ringed or annulated bodies. The term in this sense is seldom employed by other zoologists.

A'nodon, Anodonta (Gr. *a*, priv., and *odous*, *odontos*, a tooth).—The swan mussel; a genus of the *Unionida* or river mussels, deriving its name from the circumstance that its shell has no *teeth* or articular processes at the hinge. Recent and fossil.

Anomalous (Gr. *a*, not, and *omalos*, like to, or similar).—Irregular, deviating from a general rule, order, method, or analogy. **Anomaly**.—Irregularity, deviation from the common rule.

Anomodontia (Gr. *anomos*, irregular, and *odous*, a tooth).—One of Professor Owen's orders of extinct reptiles, embracing three families—the Dicyodonts, Cryptodonts, and Gnathodonts—and apparently restricted to the Triassic period. The order is characterised by the teeth being either wanting, or confluent with tusk-shaped premaxillaria, or confined to a single pair in the upper jaw, having the form and proportions of canine tusks. The vertebrae are bi-concave, the pleura-pophyses of the trunk long and curved, the pelvic bones large, and the limbs formed for walking.

Anomopteris (Gr. *anomos*, without rule, and *pteris*, fern).—Literally "anomalous fern," and so named because the plants differ from all recent and fossil ferns. In this genus, which is peculiar to the New Red Sandstone, the leaves are very large, and deeply pinnate; the leaflets long, linear, entire, and traversed by a distinct median rib; the secondary veins are simple, perpendicular to the mid-rib, and thickening towards their free extremities.

Anomoura, Anomúra (Gr. *anomos*, irregular, without rule; and *oura*, tail).—A family or sub-order of the decapod crustaceans characterised by their irregular tails—*e.g.*, the hermit-crab—and so named in contradistinction to the *brachyurous* or short-tailed crabs, and the *macrurous* or long-tailed lobsters, &c.

Anoplothérium (Gr. *a*, without; *oplon*, weapon; and *therion*, beast).—A genus of quadrupeds found in European Tertiaries, and so called from being destitute of any organs of defence, as tusks, claws, or horns. The common anoplothère (*A. commune*) has been taken as the type of a small family, the ANOPLOTHERIDÆ, which seem to constitute a sort of transition from the pachyderms to the ruminants. There are several species, from the size of a hare to that of a dwarf ass; and from the situations in which they are found, they appear to have lived in herds, in swamps and marshes. In some the tail is long and thick, as if it had assisted the animal in swimming, in others it is short and taper; in all, the legs are slender, and the feet terminate in two large toes as in the ruminants, while their tarsal bones resemble those of the camel. Their dentition is peculiar—there being six incisors in each jaw, on each side of which was a small canine, and behind these (*without leaving any interval*) seven molars, resembling those of the rhinoceros. According to Cuvier, the anoplothère stands in one respect between the rhinoceros and horse, and in another between the hippopotamus, hog, and camel.

Anórthite (Gr. *a*, without, and *orthos*, upright).—One of the felspar family; and so called (*without right angles*) to distinguish it from *orthoclase*, two of whose cleavages are at right angles to each other.

Anoura (Gr. *a*, without, and *oura*, tail).—Tailless; a class of the batrachian reptiles, including the frog, toad, &c., which are all *anourous*, or destitute of tails.—See tabulations, "ANIMAL SCHEME."

Antagonist Forces.—Two powers in nature, one counteracting the other, and preserving a general equilibrium on or within the earth's crust; *e.g.*, fire and water.

Antarctic (Gr. *anti*, opposite, and *arctic*).—Applied to the regions surrounding the South Pole, as being directly opposite to those of the Arctic or North Pole; hence we speak of the "Antarctic Circle," "Antarctic Seas," &c.

Antholites or Antholithes (Gr. *anthos*, flower, and *lithos*, stone).—The general term for the fossil inflorescence of plants, or rather the impress of their flowers. Such inflorescence occurs in the shales of the Coal-measures, and more abundantly in Tertiary strata. The affinities of the Palæozoic *antholites* are altogether undetermined; those of the Tertiary epoch seem related to the *Liliaceæ* and other existing orders.

Anthophyllite (Gr. *anthos*, flower, and *phylon*, a leaf).—A species of hornblende (tremolite), of a clove-brown colour, occurring in radiating columnar aggregates; and so named from the resemblance of its colour to that of the *anthophyllum*, or clove.

Anthracite (Gr. *anthrax*, carbon).—A species of coal almost wholly deprived of its bitumen. It may be regarded as a natural coke or charcoal, formed by subterranean or chemical heat. Ordinary bituminiferous coal is often found converted into a kind of coke by the contact of igneous rocks; and in this way some anthracites may have originated, though the majority seem to be the result of that slow change or *metamorphosis* which all rock-masses seem to undergo in the course of ages. As a mineral, anthracite

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occurs massive and amorphous (though portions have occasionally a slaty, columnar, or fibrous structure), has a sub-conchoidal fracture, less or more of a metallic lustre, or a greyish-black or iron-black colour, streak unaltered, conducts electricity perfectly, and burns open with a very weak or no flame. It varies greatly in composition, though good American sorts generally yield about 90 carbon, 8 hydrogen, 5 ashes, and the remainder oxygen and hydrogen. Submitted to the microscope, either in thin slices or in a state of ash, many varieties exhibit the vegetable structure, and leave no doubt as to the organic origin of all. Though not so convenient in an industrial point of view as ordinary coal, anthracite is gradually rising in importance for the manufacture of the metals, steam-raising, and even for household purposes—the United States at present consuming annually about six millions of tons. “It is very common” (Nicol’s ‘Man. of Mineral.’) “in many parts of the English, Scottish, and Irish coal-fields. It forms whole beds in the Alps, as in the Valais, Piedmont, Savoy, and Dauphiné; in the Pyrenees; and in various parts of France. In Germany it occurs in Silesia, Bohemia, Saxony, and the Harz, but not in very large amount. It is especially abundant in the United States, as in Rhode Island, Massachusetts, and above all in Pennsylvania, where it seems to be an altered portion of the common bituminous coal of the Western States.”—See COAL FAMILY.

Anthracoönite (Gr. *anthrax*, coal).—A mineralogical term applied to those varieties of marble which, like the Kilkenny, have a coal-black lustre when polished. Most of the black marbles contain bitumen, and yield a sulphureo-bituminous odour when struck by the hammer; and in this case, like other fetid limestones, are known as *swinestones* or *stinksteins*.

Anthracopalaemon (Gr. *anthrax*, coal; *palaemon*, prawn).—A genus of macrurous crustacean, from the Carboniferous formation of Lanarkshire, and founded by Mr Salter on the carapace, and some other fragments from the Shotts coal-field. Carapace rectangular-oblong, serrate in front and along the sides, with a faint cervical furrow at the anterior third. Rostrum strong, projecting; posterior ridge prominent, complete to the hinder margin, separated abruptly from the rostrum by the transverse furrow.—See PALÆOCRANGON.

Anthracosaurus (Gr. *anthrax*, coal, and *sauros*).—Literally “coal-saurian;” a large labyrinthodont saurian occurring in some abundance in the coal-fields of Lanarkshire, and founded by Professor Huxley, in 1862, on a beautifully preserved skull, with palatine surface, exhibiting all the teeth *in situ*, from the black-band ironstone of Airdrie. This skull (see ‘Geological Journal’) was 15 inches long, by 12 inches in width; but fragments since discovered indicate individuals nearly double these dimensions.

Anthracootherium (Gr. *anthrax*, coal, and *therion*, beast).—A fossil pachydermatous animal, first found in the Tertiary lignites or wood-coals of Cadibona in Liguria; hence the name. So far as yet determined, the genus seems to stand intermediate between river-hog and hippopotamus. In the lignites of Savone, remains of carnivora, marsupialia, bats, birds, crocodiles, tortoises, and fish occur along with those of the anthracothere.

Anthrakérpeton (Gr. *anthrax*, coal; *erpeton*, lizard).—A genus of reptiles, founded by Professor Owen, in 1864, on some remains (teeth, ribs, and portions of the cranial bones) from the coal-field of Glamorganshire. According to its describer, this small reptile “belonged to that low, probably primitive, air-breathing type, which, with developmental condi-

tions of the bones like those in some fishes, and very common in Devonian fishes, showed forms of the skeleton more resembling those in saurian reptiles than are attained by any of the more specialised batrachian air-breathers of the present day."

Anthropography.—That branch of physical geography which treats of the distribution of the human species, as distinguished by physical features, language, institutions, and customs.

Anthropoid (Gr. *anthrōpos*, man, and *eidos*, form).—Resembling the human form; applied, for example, to those species of the monkey tribe (the "anthropoid apes") that most closely approach to the form of man.

Anthropolite (Gr. *anthropos*, man, and *lithos*, stone).—A petrification of the human body; a term which has been applied to the petrified human bones from Guadeloupe and other localities. These remains can scarcely be considered *fossil*, or even *sub-fossil*; but must be regarded in the same light as any recent petrification produced by the incrusting action of calcareous waters.

Anthropology.—Literally a discourse or reasoning about human nature; the science that treats of man in a natural history point of view; the natural history of the human species, physiological, intellectual, and moral.

Anthropological.—Pertaining to the science or natural history of Man.

Anticlinal (Gr. *anti*, on opposite sides, and *kline*, I bend).—Applied to strata which dip in opposite directions from a common ridge or axis, like the roof of a house, and form what is termed an "anticline" or "saddle-back." *Syncline* and *Synclinal* are the opposite terms, which see.

Antimony.—One of the metals, of a tin-white colour, with a greyish or yellowish tarnish; somewhat sectile, but so brittle as to be easily reduced to powder by trituration; fuses at 900, and has a specific gravity of 6.712. The most abundant ore is the sulphuret of antimony, occurring in veins in the older Secondary and Transition strata. The metal is used in medicine, but principally to form alloys with other metals, as *type-metal*, which is a compound of lead and antimony. The name is derived by some from the Greek words *anti* and *monos*, signifying that it is never found by itself, but in combination with other metals; and by others from *antimoine*, that is "anti-monk," in allusion to a ridiculous story told of Basil Valentine, its discoverer in 1620, who, observing that hogs fattened rapidly on receiving small doses of it, administered it to his fellow-monks, but unluckily in such proportions as to prove fatal to them; hence the term *anti-moine*.

Antipodes (Gr. *anti*, opposite, and *pous*, *podos*, foot).—Applied to those who dwell on opposite sides of the globe, as having their feet opposed to each other. Those dwelling in New Zealand, for example, are the antipodes of those in Britain.

Antiseptic (Gr. *anti*, opposed to, and *sepo*, I putrefy).—Substances which, like common salt and tannin, prevent putrefaction in animal and vegetable matter, are said to be antiseptics, or to possess antiseptic properties.

Apateon (Gr. a cheat; deceptive).—The name originally proposed by Von Mayer for the then imperfect remains of the *archegosaurus*; because, so far as the fragments admitted of discrimination, "its head might be that of a fish, as well as that of a lizard or of a batrachian."—See *ARCHEGOSAURUS*.

Apatite (Gr. *apate*, deceptive).—A genus of calcareous earths, composed of 55.75 lime, and 44.25 phosphoric acid; hence known as phosphates of lime. In most varieties hydrochloric acid is also present, from a mere

trace up to 2.10 per cent. Apatites are of various colours, white, yellowish-white, greenish-white, brown, blue, &c., and occur both massive and crystallised. From their fracture, &c., they are spoken of as foliated, conchoidal, and massive—the massive having an uneven fracture, and being generally known by the name of “*phosphorite*.” Apatite occurs in connection with metalliferous veins in the metamorphic and granitic rocks, and is found in Cumberland, Devon, and Cornwall; in Spain, Germany, Norway, and America. The phosphorites of Spain and Norway have recently acquired additional interest from the proposal to employ them in the preparation of phosphatic manures—a purpose to which the phosphatic nodules of the English greensand have been applied with eminent success. According to Daubeny, the phosphorite of Estramadura consists of 81.15 phosphate of lime, 14.00 fluoride of calcium, 3.15 peroxide of iron, 1.70 silica, and 0.2 per cent chlorine. There is also a *talc-apatite* or *magnesian-apatite*, found in the Ural Mountains, which is probably a decomposed apatite—the lime being replaced to the extent of from 6 to 8 per cent by magnesia. From their variety of colour, fracture, &c., the apatites are apt to be mistaken for other minerals; hence the designation *deceptive*.

Aphanite (Gr. *aphanes*, not discernible).—A compact homogeneous rock of the Trap family, breaking with a smooth surface like some basalts, and consisting of hornblende, quartz, and felspar, in combination so intimate, that they are individually *undiscernible*; hence the name. It is known also as *cornean* (*cornu*, a horn), in allusion to its toughness and compact texture.

Aphélion (Gr. *apo*, from; *helios*, the sun).—The point in a planet's orbit at which it is farthest from the sun; its *perihelion* being the point at which it is nearest.

Aphrite (Gr. *aphros*, froth or foam).—Known also as *earth-foam* and *foam-spar*. A fine scaly variety of calcareous spar or carbonate of lime, having a shining pearly lustre and somewhat greasy feel. Found in veins and cavities in various formations.

Apiocrinite (Gr. *apion*, a pear, and *encrinite*, which see).—A sub-genus of encrinites, distinguished by their pear-shaped receptacle, and peculiar to the Chalk and Oolitic formations. In the Pear Encrinite the roots seem to have been confluent, the stem round and of moderate length, the digestive cavity pear-shaped, the arms rather short than slender. “When living,” says Dr Buckland (*‘Bridgewater Treatise’*), “their roots were confluent, and formed a thin pavement or crust over the bottom of the sea, from which their stems and branches rose into a thick submarine forest, composed of those beautiful zoophytes. Its stems and bodies are occasionally found united, as in their living state; the arms and fingers have almost always been separated; but their dislocated fragments still remain covering the pavement of roots that overspreads the surface of the subjacent Oolitic limestone.”

A'podal (Gr. *a*, without, *pous*, *podos*, foot).—Literally without feet; applied in zoology to those fishes which, like the eel, sword-fish, wolf-fish, &c., are destitute of ventral fins. The *Apodes* constitute the fourth order in Cuvier's arrangement, but merely a sub-order in more recent systems.

A'pogee (Gr. *apo*, from; *ge*, the earth).—That point of the moon's orbit in which she is farthest from the earth; her *perigee* being the point in which she is nearest the earth.

Apophyllite (Gr. *apophyllizo*, to strip off leaves).—One of the Zeolite

family, known also as *ichthyophthalmite* or fish-eye-stone, and deriving its present name from its lamellar or leaf-like texture, and ready exfoliation under the action of the blowpipe. It consists of 52.7 silica, 26 lime, 4.4 potash, and 16.7 water.

Apophysis (Gr. springing from, of the same nature).—A process of a bone, and part of the same bone; and in this respect differing from *epiphysis*, which is a process attached to a bone, and not a part of the same bone.

Apteryx (Gr. *a*, without; *pteryx*, a wing).—Literally "wingless;" a rare cursorial bird peculiar to New Zealand, and apparently approaching the verge of extinction. The existing apteryx, or "kiwi," of which there are two or three species, is little larger than a Guinea-fowl; but an extinct species, the *palapteryx*, has been found in the ancient river-silts of New Zealand, rivaling in size the emeu and ostrich.

Aptychus (Gr. *a*, without, and *ptyche*, fold).—A term applied by some authors to the shelly or horny organisms better known as *trigonellites*, which see. The name *Aptychus* refers to the plates or valves being without fold or hinge.

Aquafortis.—Literally *strong water*; a familiar term for nitric acid, in allusion to its power of dissolving the metals.

Aqua Marine.—A lapidary's designation for the finest *beryls*, in allusion to the varying shades of "sea-green" which they usually present.—See BERYL.

Aqua Régia.—Literally *royal water*: a designation of the alchemists for *nitro-muriatic acid*, from its property of dissolving gold, the "king of the metals."

Aquatic (Lat. *aqua*, water).—Relating to the water; having its habitat or usual position in water. Applied to plants which, like the water-lily, grow in water, and to animals which, like the diver and duck, live in or frequent the waters.

Aqueous (Lat. *aqua*, water).—Watery; pertaining to, or formed by, water. Usually applied to the *sedimentary* or *stratified* rocks, as having been formed by deposition from water, in contradistinction to the *unstratified*, or those arising from igneous fusion. **Sub-aqueous**.—Occurring under the water; in contradistinction to *sub-aerial*, or under the open air.

Aralo-Caspian.—In physical geography this term is applied to the extensive basin or depressed area occupied by the Aral and Caspian Seas, and which is a true "basin of continental streams," having no communication with the ocean. In geology, the name *Aralo-Caspian formation* has been given by Sir R. Murchison and M. de Verneuil to the limestone and associated sandy beds of brackish-water origin, which have been traced over a very extensive area, surrounding the Caspian, Azov, and Aral Seas, and parts of the northern and western coasts of the Black Sea. The fossil shells are partly fresh-water and partly marine; partly belong to living and partly to extinct species; but are in both cases related to species now inhabiting the seas and lakes of central Asia, rather than to oceanic types. The limestone rises several hundred feet above the sea, and is supposed to indicate the existence, in latter Tertiary times (Pliocene), of a vast sheet of brackish water as large or even larger than the Mediterranean.

Araucarites.—"This term," says Mantell, "is employed to designate the fossil wood whose structure is identical with that of the living *Araucariæ*, having the same kind of medullary rays, and the woody fibre, studded with discs or areolæ, which are polygonal, often hexagonal, and

disposed in several alternating series." This wood is common in the Chalk, Wealden, Oolite, and Lias of Britain; and trunks closely resembling the existing *A. excelsa* have been found in the Carboniferous formation, as at Craigleith and Granton, near Edinburgh, and also in Fifeshire. The *Araucaria* are natives of the southern hemisphere, and are all more or less gigantic trees, growing from 150 to 200 feet in height, and often from 20 to 30 feet in circumference. It is an interesting fact, therefore, to find that trees closely resembling those of Australia and the adjacent islands should at one period have flourished extensively in the northern latitudes now occupied by Great Britain.

Arborescence (Lat. *arboresco*).—Literally growing like a tree; applied to those dendritic or tree-like forms of crystallisation often observable in mineral productions.

Arca (Lat. a chest).—A genus of conchifera having a world-wide distribution, though most abundant in warm seas; and occurring in many species, from the Lower Silurian upwards. The species are characterised by their equivalve, thick, strongly-ribbed, ventricose shells, which are smooth or denticated at the margin, have a straight hinge with numerous teeth, and their umbones anterior and separated by a flat, lozenge-shaped ligamental area. The ARCADE or ark-shell family embraces such genera as *cucullæa*, *pectunculus*, *limopsis*, *nucula*, *isoarca*, *leda*, *Foldia*, and *solanella*.

Arcanite (Lat. *arcanus*, hidden, concealed).—Sulphate of potash, occurring mostly in crusts and pulverulent coatings; colourless or white; having a saline, bitter taste, and soluble in water. It is found in volcanic lavas, and in solution in the water of some salt springs.

Archæocidaris (Gr. *archaios*, ancient, and *cidaris*, a turban, hence the "sea-egg," from its turban shape).—A genus of sea-urchins or cidaris, occurring in Carboniferous and Permian strata, and characterised by their small hexagonal plates, and long spines, which in some species are smooth, in others notched and sharply denticulated.

Archæoniscus (Gr. *archaios*, ancient, and *oniscus*, woodlouse).—A genus of fossil Isopods (equal-footed crustaceans) occurring in the Purbeck or uppermost Oolitic strata, and so termed by the Rev. P. B. Brodie, from their close resemblance to the common woodlouse.

Archæopteryx (Gr.).—Literally "ancient wing or bird." A unique specimen of bird-remains from the Oolitic limestone of Solenhofen, and not, as was at first supposed, a creature intermediate between the birds and reptiles. This ancient bird, according to Professor Owen, was about the size of a rook, and differs from all known birds in having two free claws belonging to the wing, and also in having the vertebrae of the tail (about twenty in number) free and prolonged as in mammals—each vertebra supporting a pair of quill-feathers which give to the tail a long and vane-like appearance. This unique specimen (now in the British Museum) exhibits in its tail a retention of structure which is "embryonal and transitory in the modern representatives of the class, Aves, and consequently a closer adhesion to the general vertebrate type."—See ORNITHOLITES.

Archegosaurius (Gr. *archegos*, beginning, and *saurus*, lizard).—Literally "primeval lizard;" a reptile of the Carboniferous era, having, according to Owen and Goldfuss, a near alliance to the *proteus*, *lepidosiren*, and other perennibranchiate reptiles of the present day.

Archetype (Gr. *arche*, beginning, and *typos*, type).—An original model or pattern; the type after which subsequent forms are moulded.

Archipelago.—A term originally applied to the numerous islands that stud the *Ægean Sea*—the *Grecian Archipelago*; but now used to denote any similar cluster of islands—*e. g.*, the Indian Archipelago, or East India Islands.

Arctic (Gr. *arctos*, a bear).—Relating to the North Pole or Polar Regions; in reference to the constellations of the Great and Little Bears which occur in the northern quarter of the heavens, and point, as it were, to the North Pole.—*Arctic Regions*, the high latitudes surrounding the North Pole; *Arctic Circle*, an imaginary line extending round the North Pole $62\frac{1}{2}^{\circ}$ from the Equator, and parallel to it; hence certain parts are said to “lie within the Arctic Circle.” The term is also familiarly used as synonymous with cold, boreal, and frozen.

Arctic Current.—A well-known ocean current which originates in the polar regions of the north, and flows southwards towards the equator. The main current seems to originate to the north of Spitzbergen, takes a westerly direction, and thence runs southward along the eastern shores of Greenland, till it meets with a minor branch flowing from Davis Strait. The two then unite in one great current, which follows the Labrador coast, runs to the east of Newfoundland, and evidently loses itself in the “Gulf Stream;” or rather perhaps, from its greater density, passes in part under the Gulf Stream in latitudes 45° – 47° , and holds on towards the equator. It is to this current that we owe the phenomenon of icebergs in the Atlantic; and as these are frequently laden with boulders, gravel, and other miscellaneous debris, together with the remains of arctic animals, there must be now forming along the bed of the North Atlantic a deposit analogous in many respects to the “Northern Drift” or “Boulder Clay” of a former epoch.

Arenaceous (Lat. *arena*, sand).—Rocks composed of grains or particles of sand, or containing sand in any notable degree (as grits and sandstones), are said to be *arenaceous*. Compound rocks partaking of this quality are spoken of as *arenaceo-calcareous*, *arenaceo-argillaceous*, and so on, as their composition may indicate.

Arenicolites.—A term applied to those circular holes or markings which appear in twos or twins on the upper surface of many sandstones, and which seem to have been worm-burrows like those of the *Arenicola* or lob-worm (*arena*, sand, and *colo*, I inhabit).

Argentiferous (Lat. *argentum*, silver, and *fero*, I bear).—Applied to veins, rocks, and other matrices containing the ores of silver, or silver in the native or metallic state.

Argentite (Lat. *argentum*, silver).—Sulphuret of silver; an important ore of silver, occurring crystallised, also in crusts, or massive and disseminated; of a blackish lead-grey; feebly lustrous; malleable and flexible. It is found in the granitic, porphyritic, and crystalline rocks of many countries, and is one of the most important of the ores of silver. Consists of about 86.5 silver and 13.5 sulphur.

Argile Plastique.—Towards the base of the Tertiary system in France are extensive deposits of sands, with occasional beds of clay used for pottery purposes; hence the term *argile plastique*.—See TERTIARY SYSTEM.

Argillaceous (Lat. *argilla*, clay).—Applied to all rocks or substances composed of clay, or having a notable proportion of clay in their composition, as roofing-slate, shale, &c. Argillaceous rocks are readily distinguished by the peculiar odour they emit when breathed on, and known in

mineralogy as the "argillaceous odour." Compound clayey substances are spoken of as *argillo-calcareous*, *argillo-arenaceous*, &c., as the case may be.

Argillite (Lat. *argilla*, clay).—A mineralogical term for clay-slate; but very seldom used in geology.

Arkose.—A name given by Brongniart to a compound of the same materials as granite, from which its materials have evidently been derived by disintegration. "It is found," says Lyell, "at the junction of granite with formations of different ages, and consists of crystals of felspar, quartz, and sometimes mica, which, after separation from their original matrix by disintegration, have been reunited by a siliceous or quartzose cement." In Sweden it immediately flanks the granite, and forms a coarse-grained sandstone or grit.

Arm.—In geography, any deep and comparatively narrow branch of the sea running inland, in contradistinction to gulfs and firths.

Armadillo (Span.)—A well-known genus of edentate quadrupeds peculiar to the American continent, and so called from their being *armed* with an external bony shield composed of separate plates like a coat of mail. The *Glyptodon* and other gigantic congeners of the armadillo are found in the Post-Tertiary deposits of South America.

Arquerite.—A silver amalgam occurring in small octahedral crystals and in arborescent crusts in the mines of Arqueros, near Coquimbo, in Chili, whence the name. It is ductile and malleable, and consists of 86.5 silver and 13.5 mercury.—See AMALGAM.

Arragonite.—One of the calc-spar family, generally found in radiated and fibrous aggregates, in amygdaloidal cavities, and in fissures in basalt and basaltic tufas. It derives its name from Arragon in Spain, where it occurs in large maced crystals in gypsum. The coralloid varieties are usually known as *flos-ferri*, and the finely-fibrous and silky as *satin spar*. It differs from common calc-spar, or calcite, in containing from 1 to 3 per cent of strontia; but "is most readily distinguished from it by falling to pieces at a low temperature which does not affect the latter, and also by its prismatic cleavage."

Arsenic (Gr. *arsenikon*, masculine).—The metal arsenic, so called from its possessing strong or powerful properties. Arsenic occurs chiefly in veins in the crystalline and transition strata, along with ores of antimony, silver, and lead; and the purest specimens usually contain traces of antimony, iron, silver, or gold. As an ore it is generally found in granular irregular masses or disseminated; is brittle; has a whitish lead-grey colour when newly broken, but soon tarnishes on exposure to the atmosphere, and becomes coated with a black sub-oxide of the metal. When struck or heated it gives off a strong garlicky smell known as the "arsenical odour;" and on being pulverised and moistened it undergoes spontaneous combustion. It has a strong tendency to combine with other metals, hence such natural compounds as *arsenic-silver*, *arsenic-antimony*, *arsenic-glance*, &c. Arsenic is used in various pharmaceutical preparations and in metallurgic processes, but is usually injurious when mixed with ores. The metal and all its compounds are violent poisons. The *white arsenic* of the shops is arsenious acid; *realgar* or red arsenic is the protosulphuret; *orpiment* or yellow arsenic is the sesquisulphuret, and constitutes the colouring matter of the pigment called *King's yellow*; and the well-known pigment *Scheele's mineral green* is an arsenite of copper. The metallic arsenic of commerce is chiefly obtained from arsenical iron pyrites or *mispickel*, which see.

Artésian Wells.—Wells sunk by boring perpendicularly through the solid strata, and in which the subterranean waters rise to the surface or nearly so—a method long known and practised in the province of Artois (the ancient Artesium) in France. Many of the Artesian wells in London and Paris are of great depth—that in the plain of Grenelle being about 1800 feet deep, bore 10 inches in diameter, discharge 517 gallons per minute, and temperature of water 82° Fahr.; a depth exceeded by that at Columbus, in Ohio, which in 1860 was 2575 ft., the thermometer registering 88° Fahr., while the work was still proceeding. Artesian wells are generally situated in plains or in basin-shaped valleys, towards which the strata dip on one or more sides, and their principle depends upon the hydrostatic pressure of the water percolating through the inclined strata and forcing its way upward by the artificial orifice to the highest level of the water-containing strata. The greater the depth the higher the temperature; and the lower the surface of the well compared with the outcrop of the water-yielding stratum, the higher will the *jet d'eau* rise above the orifice of the bore.

Articuláta (Lat. *articulus*, a joint).—One of Cuvier's great subdivisions of the animal kingdom, comprehending all the invertebrata with jointed bodies—as insects, spiders, crustaceans, myriapods, and worms.—See tabulations, "ANIMAL SCHEME."

Articulated (Lat. *articulus*, a joint).—Jointed; composed of parts united by joint-like processes. Occasionally applied in geology to the columns of basalt and greenstone, which, like those of the Giant's Causeway, are separable into blocks more or less regular, and thus seem jointed or articulated. Indeed, in some of the more perfect columns there is a regular ball-and-socket arrangement of the separable portions.

Arundináceous (Lat. *arundo*, a reed).—Resembling, or having the structure of, reeds. Arundinaceous (that is, striated and jointed) stems are common in the Coal-measures.

Asaphus (Gr. *asaphes*, obscure).—A genus of trilobites, so called from the obscurity which long rested on the true nature of these crustaceans. In this genus the carapace is wide and much depressed; the middle lobe distinct; the head-shield rounded in front, and terminating posteriorly in a sharp process on each side. The eye of the asaphus is compound, and contains several thousand lenses.

Asbéstus, Asbestos (Gr. *a*, priv., and *bestos*, consumable or extinguishable).—Known also as *amianthus* and *byssolite*. Fine fibrous varieties of several of the hornblende family, as augite, tremolite, and actinolite, found chiefly in connection with serpentine. The fibres, often readily separable, elastic, and flexible, were used by the ancients in the manufacture of an incombustible cloth; hence the name *asbestos*, inconsumable. There are many varieties, and these receive their names from their appearance and quality—as *rock-wood*, *rock-cork*, *mountain-leather*, *fossil-paper*, *fossil-flax*, &c. In rock-wood the fibres are long, parallel, curved, and compact; in rock-cork they have a felted texture, and so light as to swim on water; in mountain-leather they form flat flexible pieces; and in fossil-flax they are so loose and silky that Dolomieu used it for packing his other minerals. Asbestos thus passes from the silky flexibility of amianthus to a degree of compactness which admits of receiving a fine polish.—See **AMIANTHUS**.

Ascidia or **Ascidians** (Gr. *askidium*, a little leathern bottle).—An order of the Tunicata or shell-less mollusca, so called from their resemblance to

small leathern pouches. They are either social or solitary, and appear as pap-like gelatinous incrustations on rocks, dead shells, and other bodies.

Asparagus-Stone.—The name given to a translucent variety of apatite, from its greenish-yellow colour, which occasionally passes into wine-yellow.

Asphalt (Gr. *asphaltos*).—This term is usually applied to a black, hard, brittle, and glossy variety of bitumen, which is distinguished from other varieties chiefly by its more difficult fusibility, and by its fracture being clean, conchoidal, and vitreous. It occurs in formations of all ages, and is associated with different kinds of rocks, though most frequently in connection with sandstones and limestones. The asphalt found floating on the Dead Sea (*Lacus Asphaltites*) was well known to the ancients; it was obtained from pits or springs near the Euphrates and Tigris, and used as mortar by the Babylonians; it is still largely found in Persia; it forms the principal feature of the "Pitch-lake" of Trinidad; an abundant commercial supply is obtained from Seyssel and other places near the Jura Mountains; and it occurs sparingly in rents and cavities in the Carboniferous limestones of Britain.—See BITUMEN.

Aspidiaria (Gr. *aspis*, *aspidos*, a shield).—A genus of lycopodian-like Coal-measure stems, so called from the shape of the leaf-scars, which closely connect them with *lepidodendron*.

Aspidorhynchus (Gr. *aspis*, *aspidos*, a shield, and *rhynchos*, a beak).—Literally "Buckler-beak;" a genus of sauroid fishes occurring in the Jurassic and upper Secondary formations, and distinguished by the tapering or beak-like prolongation of their upper jaws, which were armed with numerous sharp-pointed conical teeth.

Aspidúra (Gr. *aspis*, a shield, and *oura*, tail).—A genus of star-fishes peculiar to the Muschelkalk of Germany. They are closely related to the existing *ophiura*, and are named from the buckler-like arrangement of the ossicles that protect the arms, which are four in number.

Aspleniopteris.—A fossil fern from the Oolite and Lias; so called from its resemblance to the existing *asplenium*; but regarded by Lindley as identical with *PTEROPHYLLUM*, which see.

Assáy (Fr. *essayeur*, to try).—In mining and metallurgy, the determination of the quantity of gold or silver contained in ores or alloys of these metals by cupellation. It differs from *chemical analysis* in merely furnishing the quantity of the precious metal contained in the sample examined, instead of the nature and proportion of all the ingredients.

Assimilation (Lat. *assimilo*, I liken to).—The process by which organized bodies convert aliment into the various tissues of their own proper substance. Plants and animals increase by *assimilation* and *transformation*, minerals by *attraction* and *aggregation*.

Astacolite (Gr. *astakos*, the crayfish or lobster).—Applied to fossil or petrified crustaceans like the crayfish and lobster.

Asteracanthus (Gr. *aster*, star, and *acantha*, spine).—Literally "Starry-spine;" a genus of ichthyodolulites, so termed from having their surfaces richly ornamented with star-like tubercles. These fin-rays (often of large size) are common in the Lias, Oolite, and Wealden strata.

Astéria (Gr. *aster*, a star).—A variety of corundum or "star-sapphire," so called because, when cut *en cabochon* perpendicular to the axis of the prism, it shows a bright opalescent star of six rays corresponding to the other axes.

Astérialite (Gr. *aster*, star, and *lithos*, stone).—A term, now rarely used, for fossil or petrified *asterias*, or star-fish.

Asteridae (Gr. *aster*, a star).—The Star-fish family, of which the common five-rayed star-fish (*asterias*), so abundant on our own coasts, has been taken as the type. Representatives of the family occur, according to E. Forbes, so early as Upper Silurian strata (*Uraster*); but this has been questioned by others, who would restrict the family to Mesozoic and Neozoic strata in which such forms as *tropidaster*, *solaster*, and *goniaster* are unmistakable and abundant.

Asteroida (Gr. *aster*, a star, and *eidos*, resemblance).—An order of polypes, so called from the star-like or rayed arrangement of their tentacles when fully expanded. The asteroid polypes are all compound animals, inhabiting a polypidom, which consists of a fleshy external layer, supported upon an axis more or less calcareous and compact. The order embraces the *tubiporida*, or "organ-pipe corals;" the *alyconida*, or "dead men's fingers;" the *Gorgonida*, or "sea-fans;" and the *pennatulidæ*, or "sea-pens."

Asteroids (Gr. *aster*, star; *eidos*, likeness).—A term applied by Herschel to the minor planets or *planetoids*—Ceres, Pallas, Juno, Vesta, &c.—of which there are now upwards of seventy known to astronomers.

Asterolepis (Gr. *aster*, star, and *lepis*, scale).—Star-scale; a gigantic ganoid fish of the Old Red Sandstone, so named from the stellate markings on the dermal plates of the head, which are of great size, and form a strong expanded buckler, the orbits of the eyes being situated near the anterior border. The mouth of the asterolepis was furnished both with rows of small fish-teeth, and a thinly-set row of huge reptile-teeth. The true affinities of the asterolepis are yet undecided, if indeed it is entitled to rank even as a separate genus. See Hugh Miller's work, "Footprints of the Creator, or the Asterolepis of Stromness."

Asterophyllites (Gr. *aster*, a star, and *phylon*, a leaf).—An assemblage of plants found abundantly in the Coal-measures, Lias, and Oolite; and so called from the star-like whorls of linear leaves (verticillate leaves) which surround the jointed stems, as in equisetum, hippuris, and the like. "The genus *asterophyllites* is so vague," says Lindley, "that it will comprehend any fine-leaved verticillate plants, the basis of whose leaves do not run into an annular rim." Beyond this, and the fact that they are dicotyledonous plants, botanists have not yet determined; so that many remains now classed under "*asterophyllites*" may in reality belong to very different families.

Astræidæ (Gr. *astræa*, from *aster*, a star).—The family of "star-corals," to whose stony calcareous secretions the formation of coral reefs is mainly owing. They differ from the *cyathophyllidæ* or "cup-corals," and from the *madreporidæ* or "tree-corals," not only in their forms, but in the arrangement of their cell-rays, as well as in their mode of reproduction. The members of the family usually form thick stony masses; have the rays of the cells exceedingly numerous—the cells penetrating deeply into the mass of the coral; and most of them appear to increase by spontaneous division. The common *astræa* or "star-coral," and *meandrina* or "brain-coral," are familiar examples.

Astringent (Lat. *ad*, to, and *stringo*, I draw tight).—Applied to those substances which, like the gall-nut, oak-bark, alum, &c., have the property of contracting or drawing together the muscular fibre; hence also such substances are spoken of as "*astringents*."

Atacamite.—A native muriate of copper, so called from being found in the desert of Atacama, between Chili and Peru. It occurs in aggregates of small prismatic crystals, or massive with a granular structure. In the

granular or arenaceous state it is known as "copper sand," and consists of 72 copper protoxide, 16 muriatic acid, and 12 water. It often appears on copper long exposed to the atmosphere or sea-water, and is the *æruge nobilis* seen on antique bronzes.

Atherfield Point.—On the southern coast of the Isle of Wight—a locality of geological importance, as elucidating the nature and relations of the Greensand or lower group of Cretaceous system, and the subject of various papers by Fitton, Mantell, Ibbetson, Forbes, and others.—See Table of "EQUIVALENT DEPOSITS."

Atmometer (Gr. *atmos*, vapour, and *metron*, measure).—An instrument invented by Sir John Leslie for measuring the amount of evaporation from any moist surface in a given time. It consists of a thin hollow ball of porous earthenware, in which is inserted a tube of glass with divisions. The cavity of the ball and the tube are filled with water, and the top of the tube closed. In this state the instrument is exposed to the free action of the air, when the water transudes the porous substance and is evaporated—the scale on the glass tube marking the relative rapidity.

Atmosphere (Gr. *atmos*, vapour, and *sphaira*, sphere).—The gaseous envelope or volume of air which surrounds the earth on every side, and which is either directly or indirectly the cause of numerous geological operations,—being the great laboratory in which all meteorological and electrical phenomena are elaborated, as winds, clouds, rains, snow, hail, and thunderstorms. As an air, it is composed of about 79 parts nitrogen and 21 oxygen, with variable traces of carbonic acid and other impurities. Calculating from its decreasing density, as well as from its diminished power of refracting light as we ascend from the earth, the height or extent of the atmosphere has been estimated at 45 miles; and the pressure of the whole volume on every square inch of the earth's surface (at the ordinary sea-level) at 14.6 lb. avoirdupois. This pressure is counterbalanced by a mercurial column of 30 inches in length; hence a column of 60 inches will be equal to two atmospheres; and it is customary to estimate the force of steam, of liquid lava, and other fluid pressures, by *atmospheres*—that is, in round numbers, at the rate of 15 lb. per square inch for every atmosphere. As a *geological agent*, it is indispensable to the life of plants and animals, and any change in its normal composition would at once affect their existence. Increasing in density as we approach the earth, it becomes, as it were, the retainer and equable diffuser of the sun's rays. It is also the recipient and diffuser of all aqueous vapours arising from the earth; hence clouds, rains, snow, hail, &c. Its denser strata being heated in one region, they become lighter and ascend, and the colder and denser masses from other regions rush in to supply their place; hence aerial currents or winds; and hence also, from the contact and friction of its cloudy masses, the discharges of thunderstorms, and other electrical phenomena.

Atoll.—The name given to a coral island of an annular form—that is, consisting of a circular belt or strip of coral reef more or less continuous, with an enclosed lagoon.—See CORAL REEFS.

Atom (Gr. *a*, priv., and *temno*, I cut).—In chemistry, an ultimate particle of matter incapable of further division or reduction. In geology, applied loosely to minute particles or molecules of solid matter.

Atrypa (Gr. *a*, without, and *trypa*, a foramen).—A genus of brachiopods closely related to *rhyconella*, and often mistaken for species of *terebratula*. They are rounded shells, not furrowed like *spirifer*, but ornamented with

squamous lines of growth; the beak is small compared with terebratula, often closely incurved, and the foramen either concealed or very small and round (hence the name); hinge-line very short, and shell not punctured as in terebratula. About a dozen species are found, from the Lower Silurian to the Trias inclusive.

Attle.—A Cornish term for rubbish thrown out of a mine, containing little or no ore.

Attraction (Lat. *ad*, to, and *traho*, I draw).—Literally a *drawing towards*; a term denoting the mutual tendency of bodies towards one another—a power in nature which has been assumed as explanatory of many physical and chemical phenomena; hence such phrases as *Attraction of Cohesion*, *Attraction of Gravitation*, *Attraction of Affinity*, *Capillary Attraction*, *Magnetic Attraction*, and so forth.—See COHESION, GRAVITATION, CAPILLARY AND MAGNETIC.

Attrition (Lat. *attritus*, worn or rubbed down).—The act of wearing by friction or rubbing. In geology, the wearing and smoothing of rock-surfaces by the passage of water charged with sand and gravel, by the passage of sand-drift, the descent of glaciers, and the like.—See ABRASION.

Auchenaspis (Gr. *auchen*, the back part of the neck, and *aspis* a buckler).—A provincial genus of Old Red Sandstone fishes, closely allied to, and in all likelihood identical with, *cephalaspis*, but separated by Sir P. Egerton in consequence of the appearance of a post-cephalic or neck plate in a single specimen from the neighbourhood of Ludlow.

Augite (Gr. *auge*, lustre).—A mineral of the hornblende family, entering largely into the composition of many trap and volcanic rocks, as of basalt, greenstone, clinkstone, augite, porphyry, &c. In composition it is closely allied to hornblende proper, but differs in the form of crystal, contains less silica, is of greater specific gravity, and is also less fusible. Augite, known also as *Pyroxene*, has several varieties, which are distinguished by such names as *diopside*, *sahlite*, *malacolite*, *Baikalite*, *Fassaite*, *coccolite*, *Hedenbergite*, &c., which see. Augite, as it usually occurs, is of a greenish-black, pitch or velvet black, occasionally leek-green, but rarely brown; lustre vitreous to resinous; translucent or opaque; fracture conchoidal and uneven: crystallises in six or eight sided prisms, terminated by dihedral summits. Its constituents, taking the average of several analyses, are 53 silica, 19 lime, 15 magnesia, 6 iron protoxide, 2 manganese protoxide, and 5 alumina.

Augitic.—Containing augite; resembling augite, as *Augitic Porphyry*, a rock with a dark-grey or greenish base, containing crystals of augite and Labrador felspar. *Augitic* traps are frequently spoken of in contradistinction to *felspathic* traps and claystones.

Auricle (Lat. *auricula*, a little ear).—In natural history, any appendage or projection resembling ears. **Auricled.**—Furnished with such appendages. **Auriculated.**—Ear-shaped.

Auriferous (Lat. *aurum*, gold, and *fero*, I yield).—Yielding or containing gold; applied to rocks and veins containing the precious metal, as “auriferous veins,” “auriferous sands,” &c.

Auriform (Lat. *auris*, the ear, and *forma*, shape).—Ear-shaped; having a form resembling the human ear, as the *haliotis* or ear-shell, the *clopters* or ear-fern, &c.

Aurora Borealis (Lat.).—Literally the “Aurora of the North;” known also as the *Northern Lights*, *Polar Lights*, *Streamers*, &c. A luminous

meteor, generally appearing in the northern heavens, and so called from its resemblance to the *aurora* or morning twilight. It is usually referred to electrical agency in the upper regions of the atmosphere. Changing from the purest and softest white to all the colours of the rainbow, and flickering and flitting from the horizon to the zenith with inconceivable rapidity, the *aurora borealis* is one of the most attractive of celestial phenomena.

Auroral (Lat.)—Appertaining to the early morn; the second of the fifteen series into which Professor Rogers subdivides the Palæozoic strata of the Appalachian Chain—the “Daybreak” of the North American palæozoic, and the equivalent in part of our Middle Cambrians.—See PALÆOZOIC FORMATIONS.

Autómáliste (Gr. *automolos*, inconstant).—Octahedral corundum. A variety of corundum containing oxide of zinc, found crystallised (sometimes simple, sometimes as a macle) in talc schist, and associated with zinc-blende and galena. Its constituents, according to Abich, are 57.09 alumina, 34.80 zinc oxide, 4.55 iron oxide, 2.22 magnesia, 1.92 silica, and traces of manganese.

Autumn (Lat.)—The third quarter of the year, which commences when the sun enters *Libra*, that is, about the 21st or 22d of September, when the days and nights are equal; hence the term *Autumnal Equinox* or *Autumnal Point*, referring to the descending point of the ecliptic.

Auvergne.—A district in central France celebrated for its extinct volcanoes, its fresh-water limestones, lacustrine formations, and other ancient alluvia. The subject of Mr Scrope's valuable monograph, ‘The Volcanoes of Central France.’

Avalánche (Fr. *avalange, lavange, lavanche*).—An accumulation of snow, or of snow and ice, which descends from precipitous mountains like the Alps into the valleys below. Avalanches originate in the higher regions of mountains, and begin to descend when the gravity of their mass becomes too great for the slope on which it rests, or when fresh weather destroys its adhesion to the surface. They are usually distinguished as Drift, Rolling, Sliding, and Glacial;—*Drift* are those caused by the action of the wind on the snow while loose and powdery; *rolling*, when a detached piece of snow rolls down the steep, licks up the snow over which it passes, and thus acquires bulk and impetus as it descends; *sliding*, when the mass loses its adhesion to the surface, and descends carrying everything before it unable to resist its pressure; and *glacial*, when masses of frozen snow and ice are loosened by the heat of summer and precipitated into the plains below.—See GLACIER.

Avánturine or **Aventurine**.—A variety of quartz deriving its peculiar play of colour from imbedded spangles of mica, or merely from the intersection of minute fissures. Also, a variety of felspar or *sunstone* (which see), whose play of colour, according to Scheerer, arises from minute imbedded crystals of iron-glance. “The name *Avanturine*,” says Jackson (‘Minerals and their Uses’), “is said to be derived from the following circumstance:—A French workman having by accident, or *par aventure*, dropt some copper filings into a vitreous mixture in fusion, gave the name *Avanturine* to the sparkling mass which was thus produced; and it is still by a similar process, though greatly improved, that the artificial production is now manufactured, to be employed for various ornamental purposes. The artificial far exceeds in brilliancy the natural *avanturine*. A species of *avanturine* is also produced by heating pieces of quartz to a certain

degree and suddenly cooling them; this occasions a number of minute fissures in the mass, which, by the unequal refraction of the light, gives the stone the desired appearance."

Avicula (Lat. a little bird).—A free, unequal-valved shell, fixing itself by a byssus, the hinge without a tooth, and rather callous, valves somewhat gaping near the beaks. The type of the *Aviculida*, which embraces *avicula*, *posidonomya*, *aviculopecten*, *gervillia*, *perna*, *inoceramus*, and *pinna*. "The living shells or pearl-oysters," says Woodward, "are natives of tropical and temperate seas: there are no living species in northern latitudes, where their fossil forms are very numerous."

Avicula Contorta Zone.—A series of beds characterised by the presence of the *Avicula contorta*, and by some regarded as the upper portion of the Keuper, and by others as the basement of the Lias. From recent researches it would seem that the facies of the fauna of this zone has more affinities with the Trias than with the Lias, and may, therefore, be considered as the capping of the former system.—See **REAETIC BEDS**.

Aviculopecten.—The avicula-like pecten, an extensive genus of monomyarian bivalves peculiar to the Carboniferous Limestone, and often so well preserved that even the colours of the living shell are retained. The form in the several species is more elongated than in pecten; valves slightly unequal, and hinge without a tooth.

Axe-Stone.—A sub-species of jade, of a deep sea-green or leek colour, used by the New Zealanders, and other natives of the Pacific, for making hatchets, hangers, &c. It is sometimes called *Amazonian stone*, from its being found on the banks of the river Amazon. According to Dr Wakefield, it occurs largely in the middle island of New Zealand.—See **JADE**.

Axinite (Gr. *axine*, an axe).—One of the Garnet family, so called from the axe-like form of its crystals; the Thunerstein of Werner, who found it at Thum, in Saxony. "The crystals are attached singly, or united in druses; it also occurs massive in laminar or broadly radiated aggregates, lustre vitreous, colour clove-brown, inclining to smoke-grey or plain blue. According to Wiegmann it consists of 45 silica, 19 alumina, 12.5 lime, 12.25 iron peroxide, 9 manganese peroxide, 2 boracic acid, and 25 magnesia. It is not very abundant, and occurs chiefly in fissures, veins, or subordinate beds, in granite and the metamorphic schists, associated with quartz, felspar, asbestos, &c. The finest crystals are from Dauphiné, and from Cornwall."—(Nicol's 'Man. of Mineral.')

Axis (Lat. *axis*, a pole or axle-tree).—A word used largely and variously in natural science; applied to the line about which objects are symmetrical, about which they are bent, around which they turn, or to which they have some common relation; hence "vertebral axis," "axis of elevation," "synclinal axis," "axis of rotation," "axis of a crystal," &c.

Axotomous (Gr. *axon*, axis, and *temno*, I cut).—Applied to minerals cleavable in one particular direction.

Aymestry Limestone.—The middle member, according to Murchison's sections, of the Ludlow group of Silurian strata; so named from the village of Aymestry in Herefordshire, where it is well exposed.—See **SILURIAN SYSTEM**.

Ayr Stone.—A soft variety of whet-stone, used also for polishing marble, copper-plates, and the like; and so called from its being found near the Water of Ayr. Sometimes called *Snake-stone*, from its mottled appearance.—See **HONE**.

Azotic (Gr. *a*, without, and *zoe*, life).—Without life, void of life; a term

applied to the lowest or deepest-seated strata in the crust of the globe, such as gneiss, mica-schist, and other crystalline schists, which have yet yielded no fossils or traces of life to the paleontologist. The term is merely provisional, and founded on negative evidence, as rocks at one time regarded *azoic* have since been found to yield fossils. Used by many as synonymous with *Hypozoic*, *Non-fossiliferous*, and *Metamorphic*, which see.

Azóte (Gr. *a*, priv., and *zoe*, life).—An early, and still used, chemical term for nitrogen, because of its fatal effects (when breathed) on animal life.—See NITROGEN.

Azure Stone (so named from its colour).—A familiar term for *Lapis Lazuli*, which see.

A'surite (from its colour).—Prismatic azure-spar, or lazulite. A mineral usually occurring in mica-schist, and consisting of alumina, silica, magnesia, lime, and oxide of iron.

B

Babel Quartz.—A variety of rock crystal. "Instead of tapering gradually towards their extremities," says Mr Bristow, "as is the case with many crystals of quartz, these diminish suddenly at intervals, and are built up, as it were, of a series of short steps, which, from their fanciful resemblance to the successive storeys of the Tower of Babel, have given rise to the name."

Babingtonite (after Dr Babington).—One of the hornblende family; the "axotomous augite-spar" of Mohs. It occurs chiefly in beds of magnetic iron ore, and in veins of quartz and felspar, in small, black, attached crystals; and consists essentially of silica, iron protoxide, and lime.

Bácellaria (Lat. *bacillum*, a little stick).—A genus or rather group of Diatoms, consisting of simple siliceous frustules of a prismatic shape (whence the name), and forming a brilliant chain, which often appears in zigzag, in consequence of incomplete self-division. They abound in all waters, fresh and marine; and fossil species are equally abundant in all the so-called infusorial or microphytal earths.

Back.—A miner's term for "joints;" hence "backs and cutters" applied to jointed structure; the *backs* running in lines less or more parallel to the strike of the strata, and the *cutters* crossing these generally at right angles. Applied also in mining phraseology to that part of a mineral lode which is nearest the surface.—See JOINTS.

Bactrites.—According to Sandberger, a genus of straight, subconical-chambered shells, peculiar to the Devonian epoch; apparently the *Stenoceras* of D'Orbigny.

Baculite (Lat. *baculum*, a staff).—A straight, many-chambered, conical shell of the Chalk epoch, somewhat compressed, with marginal siphuncle, and much elongated; and so named from its straight, tapering, staff-like shape. Like other *Ammonitidae*, it consists of numerous chambers divided by transverse sinuous septa, the outer or inhabited chamber being much larger than the others, and guarded by a dorsal process. The baculites, though not specifically numerous, were individually abundant, and highly characteristic of the Cretaceous epoch. From its prevalence in the Chalk of Normandy, that rock is sometimes termed the *Baculite Limestone*.

Bagshot Sands.—A series of Lower Tertiary beds, consisting chiefly of siliceous sand, and occupying extensive tracts round Bagshot in Surrey, and in the New Forest, Hampshire. They are the equivalents of the Bracklesham beds, and may be separated into three divisions, the upper and lower consisting of light yellow sands, and the middle of dark-green sands and brown clays, the whole reposing on the London Clay.

Baikalite.—A light green, finely-crystallised variety of augite, occurring in acicular prisms, and found in granite in the vicinity of Lake Baikal in Siberia.

Bala Limestone.—(Bala in Merionethshire).—A series of dark-coloured, slaty, and sub-crystalline limestones, alternating with black slaty shales, the whole rarely exceeding twenty feet in thickness, and forming a subordinate group of the Lower Silurian, as developed in Wales.—See SILURIAN SYSTEM.

Balaenidae (Gr. *phalaina*, Lat. *balæna*, a whale).—The Whale family. According to Owen, "the remains of great whales, referable to existing genera or species, have been found in Britain, in gravel adjacent to estuaries or large rivers, in marine drift or shingle, and in the newer Pliocene beds." The remains of the great Airthrey whale, discovered in 1825, and of those found in the Clay-pits of Stirling in 1858 and 1864, were all imbedded in fine plastic marine silt, varying from twenty to thirty feet above the present medium tide-level of the Firth of Forth.

Balaenodon (*balæna*, and *odous*, *odontos*, tooth).—Sub-fossil teeth of whales not exactly referable to any known species; e.g., *B. physaloides*, which most nearly resembles the tooth of the cachalot (*Physeter macrocephalus*).—See Owen's 'Fossil Mammals.'

Balanite (Lat. *balanus*, a barnacle).—The name given to fossils of the barnacle family, whose shells in general consist of six principal valves arranged in conical form. The cirripeds or barnacles are scarcely, if at all, known till the commencement of the Oolitic era.

Balás or Balás Ruby.—The ruby of Balaksh or Balakshan.—A lapidary's term for the fine rose-red varieties of the spinel ruby, which see.

Balistes (Gr. *baleio*, I strike as with a dart).—The file-fish, so called from its rough, jagged, and dart-like fin-spines; a cartilaginous fish belonging to the sclerodermatous or hard-skinned division of the *Plectognathi*. The genus is characterised by its sub-globular body, hard, scaly, or granular dermal covering, solid teeth implanted in the jaws, and somewhat resembling the front teeth of man, and by their strong denticulated fin-spines. Speaking of fossil fin-spines or *ichthyodorrulites*, Dr Buckland remarks "that the spines of balistes and silurus have not their base, like that of the spines of sharks, simply imbedded in the flesh, and attached to strong muscles; but articulate, with a bone beneath them. The spine of balistes also is kept erect by a second spine behind its base, acting like a bolt or wedge, which is simultaneously inserted or withdrawn by the same muscular motion that raises or depresses the spine."

Banwell Cave.—An ossiferous cavern situated in the Carboniferous Limestone of the Mendip Hills in Somersetshire, and celebrated for its having yielded a number of mammalian remains characteristic of the Pleistocene period.—See OSSIFEROUS CAVERNS.

Barbadoes Tar.—A commercial term for petroleum or mineral tar, which is found in several of our West India islands.

Barégine.—The name given to a curious infusorial deposit occurring in

BAR

certain thermal waters, and so termed from its being first discovered in the hot springs of Barèges in the Western Pyrenees. When these waters are allowed to rest for some time, the barègine falls to the bottom as a greasy, amorphous, gelatinous substance, consisting (as shown by the microscope) of the exuviae of infusoria, and emitting an odour when cast on a fire like that of burnt horn. The origin of such organic deposits has not yet been satisfactorily accounted for by geological science.

Barilla (Span.)—The ashes left by the combustion of *salsola*, *salicornia*, *chenopodium*, and other maritime plants. It consists chiefly of an impure carbonate and sulphate of soda, and is used in the manufacture of soap and glass. Like British barilla or *kelp* (obtained from the burning of seaweed), barilla has fallen in demand since the introduction of Le Blanc's method of obtaining soda from common sea-salt.

Bárium (Gr. *barys*, heavy).—The metallic basis of baryta, discovered by Sir Humphrey Davy in 1808. Like sodium and potassium, it is known only to the chemist; is of a whitish-grey colour; possesses little lustre; and on exposure to air or water becomes rapidly converted into its oxide, *baryta*.

Bárnacle (Sax. *bearn*, child, and *aac*, oak).—Literally "child of the oak," expressive of the old belief that the barnacle or acorn-shell grew on trees. Whether sessile or pedunculated, the barnacles are now well-known articulated animals, either found on rocks or shells at a depth ranging from eight to ten fathoms, or affixed to bottoms of ships and other floating bodies. They belong to the *Cirripeds* or "curl-footed" order of the Articulata.—See CIRRIPEDA.

Bárolite (Gr. *barys*, heavy, and *lithos*, stone).—Heavy stone; carbonate of baryta, or *Witherite* (which see). According to its discoverer, Dr Withering, it consists of 80 barytes and 20 carbonic acid.

Barómeter (Gr. *baros*, weight, and *metron*, measure).—A well-known instrument for measuring the weight or pressure of the atmosphere by balancing a column of air against a column of mercury; and by this test determining variations in the state of the air, foretelling changes in the weather, as dependent on the conditions of the air, and measuring heights and depths as indicated by the proportional pressure of the air.

Barosélenite (*barys* and *selenite*; *selene*, lustre).—Heavy spar; native sulphate of baryta. It occurs both massive and crystallised; generally of lustrous foliated texture, hence the name. Consists of 66 baryta and 34 sulphuric acid.

Barrier-Reef.—A name given by voyagers to those coral-reefs which run parallel (*barrier-like*) to the shores of islands and continents, but separated therefrom by a lagoon-channel more or less extensive. The barrier-reefs of Australia and of New Caledonia, owing to their enormous dimensions, have long attracted the attention of voyagers.—See CORAL-REEFS.

Barystróntianite (*barys* and *strontian*).—Known also as *Stromnite*, from its occurring at Stromness in Orkney. It occurs in greyish or yellowish-white semi-translucent masses, with a faint pearly lustre and crystalline structure; consists, according to Dr Traill, of 68.6 carbonate of strontian, 27.5 sulphate of baryta, 2.6 carbonate of lime, and a trace of oxide of iron; and seems a mere mechanical mixture and not a true mineral species.

Barytes, Baryta (Gr. *barys*, heavy).—One of the simple earths, deriving its name from its great specific gravity, which is about 4.2. As determined by Davy in 1808, it is a protoxide of the metal *barium*. In nature it occurs chiefly as a sulphate or carbonate; and both of these traversing the older

formations in veins are spoken of as "heavy-spars." The native sulphate (65.63 baryta and 34.37 sulphuric acid) is generally known as *cawt* or *heavy-spar*; the carbonate (77.69 baryta and 22.41 carbonic acid) as *Witherite*, after its discoverer Dr Withering. There is also a sulphato-carbonate described by Dr Thomson. About 10,000 tons of the sulphate and 1500 tons of the carbonate are annually raised in Great Britain—Derbyshire being the principal seat of the former, and Northumberland that of the latter.

Baryto-Calcite.—Known also as *Alstonite*, from its occurring as a gangue or vein-stone in the lead-mines of Alston Moor in Cumberland; a mineral consisting of 66 carbonate of baryta, and 34 carbonate of lime.

Basalt (Gr. and Lat. *basaltis*, but of unknown origin, some deriving it from a Syriac word, *basil*, baked or burnt; others from an Ethiopic word, *basal*, iron; and others again from *als*, salt, in allusion to its usually crystallised or columnar structure).—A well-known igneous rock occurring in the Trap and Volcanic series, but most abundantly in the former. Basalt belongs to the augitic division of trap-rocks, and consists essentially of augite and felspar—the former predominating. It is close-grained, hard, usually black, and frequently columnar; the columns or rather prisms being three, five, or more sided, regular and jointed. The columnar structure seems to be the result of cooling, and the columns always lie at right angles to the cooling surface; but the columnar structure is by no means essential to basalt, which also occurs tabular and massive, and passes insensibly through basaltic clinkstone and basaltic greenstone to greenstone proper. The typical basalt (like that of Giant's Causeway, Fingal's Cave, Samson's Ribs near Edinburgh, &c.) generally contains crystals of the olive-green mineral *olivine*, disseminated iron-pyrites, and other substances. The most remarkable basaltic columns are perhaps those of Mont Bonnevie near Murat in Auvergne, where they can be obtained from 50 to 60 feet in length unbroken by joint or flaw, and not more than 8 or 10 inches in diameter.—See TRAPPEAN ROCKS.

Basaltic.—Composed of basalt; containing basalt. **Basaltiform.**—Resembling basalt in its columnar structure.

Basaltine.—The name given by Kirwan to crystallised hornblende, because it is "mostly found in basalts and lavas."

Basanite (Gr. *basanizo*, to test; hence *basanos*, a touchstone).—Lydian stone or touchstone; a variety of schistose hornstone formerly, and still occasionally, used for testing the purity of gold. Consists of upwards of 75 silica, with lime, magnesia, carbon, and iron. Also a name given by Brongniart to a rock having a base of basalt, with more or less distinct crystals of augite disseminated through it.

Basileosaurus (Gr. *basileus*, a king, and *saurus*, lizard).—Literally "King of the Saurians," the name originally given by Dr Harlan to the huge skeleton (between 70 and 80 feet long) discovered in the Eocene beds of Alabama, from the belief that it was of saurian affinity. Now known to be a cetacean or whale, and termed *ZUGLUDON*, which see.

Basin.—In geology, any dipping or disposition of strata towards a common centre or axis is termed a *basin*, *trough*, or *syncline*. As the natural disposition of strata is less or more horizontal, such basins must have been formed by upheaval and subsidence of the earth's crust; and just in proportion to the intensity of the disturbing causes, so we find basins of greater or less extent, and in which the beds dip at all angles towards the

axis of depression. The Tertiary formations often occupy limited areas, and fill up such depressions in the older rocks; hence the use of such phrases as "London Basin," "Paris Basin," "Vienna Basin," &c. In geography, the term applies to the whole extent of valley-shaped or basin-shaped country drained by any river and its tributaries, as the "Basin of the Forth," &c. In a wider sense, also, to the depression or receptacle of seas and lakes and the areas from which they receive their waters, as the "Basin of the Caspian," the "Basin of the Mediterranean," &c.

Bâsset or Basset Edge.—A miner's term for the outcrop or surface-edge of any inclined stratum.—See **OUTCROP**.

Bastard (Fr.)—Spurious; not genuine. Often applied by workmen to rocks and minerals that are impure, or contain such admixture of impurity as to render them economically worthless; as "bastard limestone," an impure siliceous limestone incapable of being converted into quicklime when burnt in the kiln.

Bath-Brick.—A well-known material used for cleaning and polishing metal goods and utensils. It is manufactured at Bridgewater from a tidal deposit of fine siliceous silt, deposited in the river Parret in Somersetshire, at the junction of the fresh and salt water. "The peculiar properties of this material," says Ansted, "are probably owing to the siliceous cases of infusorial animalcules destroyed by the salt tidal-water where it meets the fresh water of the river."

Bath-Stone.—A familiar term for the "Great Oolite," which is extensively quarried for building purposes in the neighbourhood of Bath. When raised from the quarry the Oolitic freestones are soft and easily dressed, but become hard on exposure to the atmosphere.—See **OOLITE**.

Bathymétrical (Gr. *bathys*, deep, and *metron*, measure).—Applied to the distribution of plants and animals along the sea-bottom, according to the depth of the zone (measuring from the shore) which they inhabit.—See **ZONE**.

Batrachia (Gr. *batrachos*, a frog).—A subdivision of the *Reptilia*, comprising the frog, toad, salamander, and siren. Regarding the Batrachia as an order, Professor Owen (1859) specialises some as having biconcave vertebræ (*Siren*), some concave before and convex behind, as the frog (*Rana*), and others as concave behind and convex in front, as *Ripa*. In all, the pleurapophyses are short and straight; the occipital condyles two; two vomerine bones mostly dentigerous; no scales or scutes. True batrachians are found chiefly in Tertiary and Post-Tertiary strata.—See **REPTILIA**.

Batracholites (Gr. *batrachos*, frog, and *lithos*, stone).—Fossil remains of true batrachians or animals of the frog kind. "The skeletons, vestiges of the soft parts, and imprints of the feet of several genera of true batrachians," says Mantell, "occur in a fossil state in Tertiary deposits, all of which, like existing races, appear to belong to fresh-water or terrestrial species. In the Pliocene or newer Tertiary strata, on the banks of the Rhine at Cöningen, and in the *papier-kohle* of the Eifel, several species of frog, toad, and newt have been discovered. Fossil frogs of a small species, very similar to the recent, occur in numbers in a dark shale, overlaid by basalt, in the vicinity of Bombay."

Batrachnitis (Gr. *batrachos*, a frog, and *ichnos*, footprint).—A provisional genus of batrachian or frog-like footprints occurring in the New Red or Triassic sandstones of Corncockle Muir, Dumfriesshire, and described by Sir W. Jardine in his 'Technology of Annandale.'

BAY — BEL

Bay.—Any bending of the ocean into the land, less sudden and contracted than a *creek* or *harbour*, and communicating more openly with the main ocean than a *sea* or *gulf*; "Bay of Biscay," "Bay of Bengal." Geologically, bays are the grand recipients of marine drift, and are usually fringed or headed by belts or expanses of sand-drift or sand-dunes.

Bay Salt.—A general term for coarse-grained salt, but properly applied to salt obtained by spontaneous or natural evaporation of sea-water in large shallow tanks or *bays*.

Beach.—The shore of the sea; the strand. Strictly that space along the margin of a tidal sea over which the tide alternately flows and ebbs.—See RAISED BEACHES.

Beatricea.—A remarkable fossil occurring in the Middle Silurians of Canada, and at first supposed by Mr Billings to be the stem of a tree-fern. The appearance of vegetable structure has since, however, been ascertained by Dr Hooker to be deceptive, and due to crystallisation. Mr Salter believes that the *Beatricea*, though thirty feet long, may be a gigantic annelide tube allied to *Cornulites*. The living *Amphitrite* has a shelly tube several feet in length.

Béchera.—One of Brongniart's genera of fossil plants with tumid articulate stems and verticillate leaves; now merged into *ASTEROPHYLLITES*.

Bed.—This term is usually applied both by geologists and quarrymen to a stratum of considerable thickness, and of uniform homogeneous texture—*e. g.*, "bed of sandstone," "bed of clay," &c. Originally and strictly, however, the term *bed* referred to the surface-junction of two different strata, and *seam* to the line of separation between them. Thus the upper surface of a stratum may be smooth, or it may be rough and irregular, and the under surface of the stratum deposited on it must partake of this smoothness or this irregularity—this is *bedding*; the line that marks the separation between two strata is the *seam*.

Beekites.—After Dr Beeké, Dean of Bristol, by whom they were first noticed. Concretionary forms of chalcedony found encrusting fossil sponges, corals, shells, and the like; and occurring for the most part in the conglomerates of the New Red Sandstone. They resemble in form the pebbles among which they are imbedded, but are readily distinguished by their composition and tubercular surface. They are frequently hollow,—the organic nucleus being entirely decomposed. Abundant in the pebbly conglomerate of Torbay.

Beetle-Stone.—A name given to coprolitic nodules of ironstone, &c., from the fanciful resemblance (when the nodule is split up) of the enclosed coprolite, and its radiating films of calc-spar, to the body and limbs of a beetle. The finest specimens are found in the feriferous shales of the Coal-measures—many of them being susceptible of a fair polish, which materially assists in bringing out the beetle-like aspects of the fossil nucleus.—See SEPTARIA.

Belémnite (Gr. *belémnon*, a dart).—An abundant Cretaceous and Oolitic fossil, apparently the internal bone or shell of extinct naked cephalopods allied to the squid and cuttle-fish. Belemnites are usually found as straight, solid, tapering (dart-like) fossils; but occasionally the upper or chambered portion is attached, and even in some instances the colouring matter of the ink-bag has not been altogether destroyed. The *pen* of the common squid (*Loligo*) is a slender and insignificant organ compared with the belemnite and its extinct congeners, which seemed to have thronged

BEL

the seas of the upper Secondary period. Upwards of eighty species have been described, and nearly one half of these occur in British strata. "A belemnite," says Dr Buckland ('Bridgewater Treatise'), "was a compound internal shell, made up of three essential parts, which are rarely found together in perfect preservation. *First*, A fibro-calcareous cone-shaped shell, terminating at its larger end in a hollow cone. *Secondly*, A conical thin horny sheath or cup, commencing from the base of the hollow cone of the fibro-calcareous sheath, and enlarging rapidly as it extends outwards to a considerable distance. This horny cup formed the anterior chamber of the belemnite, and contained the ink-bag and some other viscera. *Thirdly*, A thin conical internal-chambered shell, called the *alveolus*, placed within the calcareous hollow cone above described. This chambered portion of the shell is closely allied in form, and in the principles of its construction, both to the nautilus and orthoceratite. It is divided by thin transverse plates into a series of narrow air-chambers or *areolae* resembling a pile of watch-glasses, gradually diminishing towards the apex. The transverse plates are outwardly convex, and are perforated by a continuous siphuncle, placed on the inferior or ventral margin."

Belémnotenthis (Gr. *belemnion*, a dart, and *tenthis*, the squid or cuttle-fish).—A genus of the Belemnite family of cephalopods occurring in the Lias and Oolite, and occasionally so well preserved that the receptacle and ink-bag have been found in their natural relative positions, together with the remains and impressions of the mantle, body, tentacles with their hooks, and the fins! According to Mr Woodward, the belemnoteuthis had eight nearly equal arms, each furnished with twenty to forty pairs of hooks, forming a double alternating row; and the tentacles, which were not longer than the arms, were similarly provided. In all essential points of structure it is most nearly related to the existing calamaries (*Tenthide*), but in consequence of its posteriorly-pointed shell, its fins were lateral instead of terminal, whilst the chambered structure of its shell and the character of tentacles show that it must be regarded as a type distinct from and equal in importance to the existing calamaries.

Belémnosiphis (Gr. *belemnion*, dart, and *siphos*, sword).—A genus of solid-beaked dolphins occurring in upper Tertiary strata, and so named by Professor Huxley from their long straight snouts, the only portions of their skeletons which have yet been detected.

Bellerophon (a fanciful appellation from Bellerophon, a fabulous hero of Grecian antiquity).—An extensive genus of fossil nautiloid shells, consisting of a single chamber like the living argonaut. They occur in the Silurian, Devonian, and Carboniferous strata, upwards of twenty species being met with in the mountain-limestone. The *Bellerophonitidae* are most generally regarded as belonging to the *Heteropoda*, and allied to the Glass-shell (*carinaria*); though by some they are considered to be a simple form of *Cephalopod*.

Bell-Metal.—A well-known alloy of copper and tin, to which small proportions of other metals (zinc, lead, &c.) are occasionally added, according to the quality of the tone required—the larger the proportion of copper the graver the tone.

Bell-Metal Ore.—A Cornish miner's term for STANNINE or sulphuret of tin, in allusion to its brilliant bell-metal colour. As an ore it consists essentially of tin and copper-pyrites.

Belóptera (Gr. *belos*, a dart, and *pteron*, wing).—A curious belemnite-looking organism occurring in Tertiary strata, and evidently the internal

bone of a cephalopod, but less pointed than the belemnites, and having a wing-like projection or process on each side; whence the name. As a genus it holds a place intermediate between the Cuttle-fish and the *Spirulirostra*.

Belosépia (Gr. *belos*, a dart, and *sepia*, the cuttle-fish).—A provisional genus of short, flattened, belemnite-looking organisms occurring in Tertiary strata, and evidently the internal bone or shell of a cephalopod allied to the existing *Sepia*; hence the name.

Belotérithis (Gr. *belos*, a dart, and *teuthis*, a squid or calamary).—A genus of flattened, spear-head-shaped belemnites occurring in the Lias, and so termed from their apparent affinity to the squids or calamaries of existing seas.

Beréngellite.—One of the mineral resins, occurring, according to Professor Johnston, in large amorphous masses, having a conchoidal fracture, dark-brown colour inclining to olive, a resinous unpleasant odour, and bitter taste. It consists of 72.40 carbon, 9.28 hydrogen, and 18.31 oxygen. It is said to form a lake in the province of St Juan de Berengela in South America, and is used at Arica to caulk vessels.

Berg (Swedish *berg*, a mountain).—An abbreviated term for iceberg, which see.

Berg-Mahl, Berg-Mehl (Swedish).—Literally "mountain-meal;" a recent infusorial or rather microphytal earth of a whitish colour and mealy grain; hence the name, and hence also the term "*fossil farina*," by which it is occasionally designated. Such earths are of common occurrence in bog and ancient lake-deposits (as in Finland, Iceland, San Fiora in Tuscany, &c.), and consist almost exclusively of the siliceous shields of microscopic plant-growths (Diatoms) and of Infusoria. In times of scarcity the Finns and Laps are said to mix the *berg-mahl* with their food, just as the Indians swallow similar clays to appease the cravings of hunger; but beyond mere traces of organic matter, analysis does not seem to indicate the presence of any nutritive principle.

Béryl (Persian *belur*, Lat. *beryllus*).—A lapidary's term for the less brilliant and colourless varieties of the emerald—this want of colour arising from the absence of chromium, which gives to the emerald its deep rich green. The finest beryls or *aqua marine* are found in Siberia, chiefly in druses or veins in granite, along with rock-crystal or tourmaline and topaz. Some crystals exceed a foot in length, but others of still larger dimensions have been found in the United States. Esteemed gems also occur in the granites of Wicklow and Aberdeen; in Norway, Bavaria, the tin-mines of Bohemia, Brazil, and other localities. "Pebbles of quartz," says Mr Bristow, "are sometimes taken for beryls, and *vice versa*. The two may be distinguished by observing that the crystals of beryl are striated longitudinally, while those of quartz are striated transversely, or at right angles to the axis of the prism. Moreover, the fracture of the two minerals is widely different, for the beryl breaks in smooth planes, the faces of which are at right angles to the axis of the crystals, whereas the fractured surface of quartz is invariably conchoidal."—See EMERALD.

Beryx.—A genus of ctenoid fishes belonging to the Perch family, the living species of which inhabit the seas of Australia. A number of species have been obtained from the Chalk of the south-east of England, where it is one of the most common ichthyolites, and known to the quarrymen by the name of "Johnny Dory." The specimens are short, robust, perch-

like fishes from four to twelve inches long, having very large heads, large eye-orbits, broad opercular pieces covered with sculptured rays, and the margins of the jaws furnished with a broad band of brush-teeth. The body is covered with large round scales having several concentric rows of denticles, and the single dorsal fin has several spinous rays in front of the soft rays.

Berzeline (after Berzelius, the chemist).—Seleniuret of copper, occurring in crystalline dendritic crusts in fissures of calc-spar in the copper-mines of Sweden and Saxony.

Bérzelite (after Berzelius).—A name given to several minerals in honour of the great Swedish chemist. The *Berzelite* of Kühn is a honey-coloured, massive arseniate of lime and magnesia; the *Berzelite* of Lévy a muriate of lead—a very rare mineral, generally known as *Mendipite*, from its occurring in the Mendip Hills, Somersetshire.

Bethersden Marble (from Bethersden in the Wealds of Kent).—A freshwater limestone of the Wealden formation, and better known as *Sussex* or *Petworth Marble*, which see.

Beyrichia (after M. Beyrich).—A genus of minute phyllopodous crustaceans belonging to the family *Limnadiadae*, of which the existing *Limnadia* has been taken as the type. They are bivalved, and their minute three-lobed-like coverings occur in profusion both in lower and upper Silurian strata, but more abundantly in the latter—where hundreds, from the size of pin-heads and upwards, may be seen attached to the crusts of *Eurypterites*, as if they had led, like many of their existing congeners, a parasitic life on crustaceans and fishes.

Bezoar Stones.—A term occasionally employed to designate those stony concretions which are usually composed of several crusts, one within another, and having these crusts closely cohering without any internal cavity.

Bi (Lat. *bis*, twice).—A frequent prefix signifying *two*, *twice*, or *in twos*; as *bimana*, two-handed; *biennial*, living for two years, or occurring every second year; *bifurcate*, two-forked, and so on.

Bicuspid (Lat. *bis*, and *cuspis*, a spear).—Two-pointed; two-fanged; two-pronged. The “false molars” or pre-molar teeth in the human subject are frequently termed the *bicusps*.

Biennial (Lat. *bis*, and *annus*, a year).—In botany, enduring throughout two years and then perishing; applied to plants which do not bear flowers and seed till the second year, and then die.

Bifid (Lat. *bis*, twice, and *findo*, *fidi*, I cleave).—Cleft or cloven into two; opening with a cleft, but not deeply divided.

Bifurcated, **Bifurcation** (Lat. *bis*, and *furca*, a fork).—Forked; divided into two heads or branches.

Bilateral Symmetry (Lat. *bis*, both, and *latus*, the side).—That construction in vertebrate animals by which the organs of the body are arranged more or less distinctly in pairs on each side of the body.

Bildstein (Ger. *bild*, shape, and *stein*, stone).—A German term, sometimes used in English works for *agalmatolite* or *figure-stone* (which see). Called *steatite-pagodite* by Brongniart, from its coming from China in grotesque figures and pagodas.

Bimana (Lat. *bis*, twice, and *manus*, hand).—Literally two-handed. In zoology, the order of mammalia of which Man is the sole representative; the apes and monkeys being *quadrumanous*, or four-handed.—See tabulations, “ANIMAL SCHEME.”

with traces of lime and magnesia. When the magnesia is in notable proportion, the boles become greasy or soapy in feel; hence the terms "mountain-soap," the "fett-bol" of the Germans, and the "Sinopian" and "Lemnian earths" of antiquity, which see.

Bolognian or Bolognese Stone.—A radiated variety of sulphate of barytes, found in rounded masses near Bologna, which, after being heated and placed in the sun's rays, phosphoresces in the dark.

Bone Bed.—A term applied to several thin strata or layers, from their containing innumerable fragments of fossil bones, scales, teeth, coprolites, and other organic debris. One of the best known is that which caps the New Red Sandstone or Trias in the south of England. It is found at Axmouth in Devonshire, and at Westbury and Aust in Gloucestershire—places fully sixty miles apart—the bed itself never being more than two or three feet thick, and frequently only as many inches. Another occurs at the junction of the Upper Silurian and Old Red Sandstone in Herefordshire. This is rarely more than a foot thick, and often only one or two inches, and has been traced at intervals over a space of forty-five miles, from Pyrton Passage to the banks of the Teme near Ludlow.

Bone Breccia.—A conglomerate, or rather admixture of fragments of limestone and bones, cemented together into a hard rock by a reddish calcareous concretion, and occurring in caverns, fissures, and the like, of later Tertiary date. This breccia is found in almost all the islands on the shores of the Mediterranean Sea, as at Gibraltar, Cetta, Nice, Corsica, Palermo, &c.; in many of the ossiferous caverns of Europe; and similar admixtures occur also in the bone caves of England. Bone breccias of analogous date, but containing the bones of marsupial animals only, have been found in the caves of Australia.—See OSSIFEROUS CAVERNS.

Bone Earth.—The earthy or mineral part of bones, which consists chiefly of the phosphate of lime.

Boracic Acid.—The *Sassoline* of some mineralogists; a compound of boron and oxygen, occurring in minute pearly scales, in crusts, or stalactitic aggregates, in the neighbourhood of hot springs and volcanoes. Upwards of 200,000 lb. are annually obtained from the hot springs or *lagoni* of Tuscany, by evaporating the water.

Bóracite.—Borate of magnesia; an anhydrous compound of magnesia and boracic acid, consisting of 30.2 magnesia and 69.8 boracic acid. It is usually associated with gypsum; but a compact variety occurs in Germany, forming beds with rock-salt and gypsum.

Borax.—Native borate or bi-borate of soda, found associated with rock-salt in loose crystals in the clay on the shores of certain lakes in Tibet and Nepal, in South America and in Ceylon. In its rough or impure state it is known as *tincal*, and from this the pure borax of commerce is derived. It is also made in large quantities from the boracic acid of the Tuscan lagoons. Borax forms the most valuable reagent for blowpipe experiments; is used in the preparation of fine glass and artificial gems, in medicine, and in South America as a flux for smelting copper.

Bord.—A miner's term for the face of coal parallel to the natural fissures, in contradistinction to *End*, which is at right angles to the natural fissuring.

Bore.—A violent rush of tidal water; the advancing edge or front of the tidal wave as it ascends a river or estuary; e.g., the "bore" of the Hooghly, the Garonne, the Severn, the Tsientang, &c. The bore of the

Tsientang is said to advance up that river, at Hangchau, like a wall of water, thirty feet in height, and at the rate of twenty-five miles an hour, sweeping everything before it.

Bóreal (Lat. *Boreas*, the north wind).—Of or belonging to the north; e.g., Boreal Regions, Boreal Fauna, &c. The shells of the "Clyde Beds" resembling those of Greenland and other existing arctic seas, these beds are said to have been deposited under cold or "boreal conditions."

Bornia.—Sternberg's term for a genus of Coal-measure plants with verticillate leaves; the same as the *Asterophyllites equisetiformis* of Brongniart and Lindley, which see.

Bornite.—The "purple copper" and "variegated copper" of some mineralogists; an ore of copper of a reddish pinchbeck colour and pale-blue tarnish; mostly found massive and disseminated in rocks of various ages, as in the copper-slate of Germany, the crystalline schists of Norway, &c.; and consisting of about 60 copper, 14 iron, and 26 sulphur.—See COPPER.

Boron.—In chemistry, one of the elementary substances; the indecomposable base of boracic acid, from which it was obtained by Davy, by the action of the voltaic battery. It occurs in the form of a fine mealy-white powder, and has a weakly bitter taste, but not at all acid.

Bort or Boort.—A kind of diamond, forming from two to ten per cent of the rough diamonds imported from Brazil. "It is generally," says Mr Bristow, "of a spherical shape, and appears to be formed of a confused mass of interlaced and twisted parts, like the knots in a piece of wood. For this reason it cannot be cleaned like ordinary diamonds, and is only of use as a material for polishing other stones, for which purpose it is broken and reduced to powder in a mortar. Its colour is mostly greyish-white, and its specific gravity exceeds that of ordinary diamonds."

Bos (Lat.).—In zoology, the technical generic term for the Ox kind, of which there are several existing species—*taurus* or common ox, *urus* or aurock, *bison*, *bubalus* or buffalo, *grunniens* or yak, *moschatus* or musk-ox, &c. The genus occurs fossil, or rather sub-fossil, in the Upper Tertiaries and Post-Tertiaries of Europe and Asia.—See BOVIDÆ.

Boss (Fr. *bosse*).—A knob or protuberance; a convenient term in geology for rounded masses of rock that have resisted denudation, for sudden mound-like swellings of quaquaversal strata, and for sudden protrusions of trap or other igneous rock.

Bothrodéndron (Gr. *bothros*, a pit or cavity, and *dendron*, a tree).—A genus of Coal-measure stems with dotted surfaces, and distinguished from sigillaria and stigmaria by two opposite rows of deep oval concavities which appear to have been made by the bases of large cones or seed-bracts ('Fossil Flora,' vol. ii.). In the *Ulodendron* (which see) the pit-like scars are rounder and more closely placed, while the surface of the stem is covered with tessellated scales like the lepidodendron, and not dotted.

Botryoidal (Gr. *botrys*, a bunch of grapes).—Applied to certain concretionary forms, as those occurring in the magnesian limestones of Durham, the hematites of Westmoreland, &c., which resemble clusters of grapes.

Botryolite (Gr. *botrys*, a bunch of grapes, and *lithos*, stone).—A variety of *Datholite*, or borate of lime, occurring in small botryoidal or reniform crusts in the magnetic iron-ore of Arendal in Norway.

Bottle-Track.—The name given to the course pursued by bottles which are thrown overboard with a note enclosed of the longitude and latitude

where and the date when they are dropped in the ocean. By this means the set-in and velocity of currents are rudely indicated.

Bottom Bed.—A term occasionally employed by English geologists to designate those partially or doubtfully fossiliferous strata which immediately underlie the Silurian system in Wales. They constitute the Lower Cambrian formation of Sedgwick, and embrace the Bangor slates, Harlech grits, and Llanberis schists.

Boulders (Sax.)—Any rounded or water-worn blocks of stone, which would not, from their size, be regarded as pebbles or gravel, are termed *boulders*. The name, however, is usually restricted to the large water-worn and smoothed blocks ("erratic blocks") found imbedded in the clays and gravels of the Drift formation of the Pleistocene epoch, which covers the northern hemisphere, in both worlds, down to the 40th or 42d parallel of latitude.

Boulder-Clay.—A term in frequent use by British geologists to designate those stiff, tenacious, un laminated clays of the glacial or "Drift" epoch, which are widely spread over Great Britain, and easily distinguishable from other clays by the numerous boulders and pebbles interspersed throughout their mass. These water-worn blocks have evidently been dropped in deep water from floating ice, and have settled in the clayey silt, without regard to specific gravity, or any other arrangement. The clay itself usually partakes of the colour of the formations from whose immediate waste it has been derived: red in Old Red Sandstone tracts, dark-blue in Coal-bearing districts, and creamy or chalky white in Oolite and Chalk areas.—See **DRIFT**.

Bourgueticrinus (after M. Bourguet).—A genus of encrinites occurring in the Chalk and Lower Tertiaries, and much resembling *Aptiocrinus*, under which it was at one time included.

Bournonite.—A plumbo-cupreous sulphuret of antimony, named after Count Bournon, who first discovered it at Endellion in Cornwall, and hence known also as *Endellionite*. It is of a steel-grey colour, and occurs in thick tabular crystals or massive in granular aggregates, and consists of 41.8 lead, 12.9 copper, 26 antimony, and 19.3 sulphur.

Bourrans.—The name given to the fierce snow-storms that blow from the north-east over the steppes of Russia, and which often rage for twenty-four hours at a time.

Bovey Coal.—A local designation for the Tertiary lignite or brown coal which occurs at Bovey in Devonshire, where it is worked for the potteries. There are several beds, varying from two to sixteen feet in thickness, and interstratified with clays—the whole forming a local deposit of limited extent. The lignite appears in every degree of purity, from the woody-looking "board coal" of the miner to a soft earthy mass almost undistinguishable from peat.—See **LIGNITE**.

Bovidae (Lat. *bos*, *bovis*, an ox).—The Ox tribe; a well-known family of ruminants, whose remains are not known to occur in deposits of older date than the Pliocene and Pleistocene Tertiaries. "At those periods," says Owen, "there existed in Britain a very large species of bison (*Bison priscus*), and a large species of ox (*Bos antiquus*) from fresh-water Pliocene beds; whilst a somewhat smaller but still stupendous wild ox (*B. primigenius*) has left its remains in Pleistocene marls, both in England and Scotland. With this was associated an aboriginal British ox of much smaller stature, and with short horns (*B. longifrons*), which continued to exist un-

til the historical period, and was probably the source of the domesticated cattle of the Celtic races before the Roman invasion. A buffalo not distinguishable from the musk kind (*Bubalus moschatus*), now confined to the northern latitudes of North America, roamed over similar latitudes of Europe and Asia, in company with the hair-clad elephants (Mammoths) and rhinoceroses."—('British Fossil Mammals.')

Brachiolites (Gr. *brachion*, an arm, and *lithos*, stone).—A fossil zoophyte or bryozoan occurring abundantly in the Chalk of the south of England, presenting a puckered or folded fungiform appearance, and furnished with radical and lateral processes; whence the name.—See Mr Toulmin Smith's 'Memoir on the Ventriculides.'

Brachiopoda (Gr. *brachion*, an arm, and *pous, podos*, a foot).—A numerous order of mollusca, including equal and unequal valved genera, and having one shell placed on the back of the animal, and the other in front. They have no special breathing organs, but the mantle performs that office: they take their name from two long, spiral, ciliated arms, developed from the sides of the mouth, which they can uncoil and protrude, and with which they create currents that bring them food—e.g., *terebratula*, *spirifer*, *producta*, &c. The Brachiopods were more abundant, generally and numerically, in Palæozoic than in Neozoic epochs, and have been much studied by palæontologists.—See MOLLUSCA and PALLIOBRANCHIATA.

Brachy.—A Greek word signifying *short*, and frequently made use of in scientific compounds; as *brachyurous*, short-tailed; *brachypteryx*, short-winged; *brachycera*, short-horned, &c.

Brachycephalic (Gr. *brachys*, short; *kephale*, the head).—Literally "short-headed;" applied in scientific descriptions to the form of the head in animals—e.g., the brachycephalic or short-headed tribes of the human family.

Brachyphyllum (Gr. *brachys*, short, and *phyllum*, leaf).—A coniferous-looking plant occurring in terminal twigs and branches in the Oolitic formation, and so called from the short, ovate, ribless, scale-like leaves which surround the branches. Judging from its leaves and general aspect, Lindley would ally it with the *Araucaria*, *Callitris*, and *Dacrydium*.

Brachyúra (Gr. *brachys*, short, and *oura*, tail).—A sub-order of the Decapod crustaceans, in which the abdomen is always converted into a short jointed tail, quite destitute of terminal appendages, and bent round so as to fold closely under the breast, as in the common edible crabs. The brachyura are not known in a fossil state earlier than the Lower Cretaceous or Greensand period.

Bracklesham Beds.—A series of Lower Tertiary sands and clays immediately overlying the London Clay, and so called from being well exposed at Bracklesham Bay, near Chichester, in Sussex. They contain the gigantic cerithium, volutes, cowries, bones of fishes, crocodiles, and sea-serpents; and thus seem to favour the idea of a warm climate having prevailed in these latitudes during the period of their deposit.

Bradford Clay.—A member of the Oolitic system, equivalent with, or immediately overlying, the Great Oolite. It is well developed near Bradford, and consists of a pale greyish clay, slightly calcareous, and enclosing thin slabs of tough brownish limestone. It rarely exceeds sixty feet in thickness, and is remarkable for the number of its *Apiocrinites*, which are consequently sometimes termed the "Bradford Encrinite."

Branchia (Gr. a gill).—The *branchiæ* or gills are the respiratory organs

of those animals that breathe water instead of air. They vary greatly in their structure and position in different animals.

Branchiostegal, Branchiostegous (Gr. *branchia*, gill, and *stego*, I cover).—Gill-covering; applied to certain bones or bent rays that support the membrane which covers and protects the gills of fishes. The branchiostegal rays are often very beautifully preserved even in Palaeozoic fishes.

Brard's Process.—A method adopted by M. Brard to discover in a short time the relative resistance offered by different kinds of rock to the action of damp and frost, and therefore to determine their durability with reference to exposure. It consists in boiling small cubes of the stones to be tested in a saturated solution of sulphate of soda (Glauber's salts), and then suspending them for four or five days in the open air. As they dry they become covered with an efflorescence of crystals, which must be successively washed off till the efflorescence ceases. If the stone resists the decomposing action of damp and frost, the salt does not force out any portions of the stone with it; on the other hand, if it yields to this action, small fragments will be perceived to separate themselves, and the cube will gradually lose its angles and sharp edges. The amount of this disintegration affords, according to the author of the process, a criterion of what would be produced in course of time by the action of the weather. According to other authorities, the expansion of water under frost, and the almost inappreciable expansion of Glauber salt while crystallising, are so very different things, that the one cannot by any means be taken as a test of the effects of the other.

Brash.—"In almost every country," says Sir Charles Lyell, "the alluvium consists in its upper part of transported materials, but it often passes downwards into a mass of broken and angular fragments, derived from the subjacent rocks. To this mass the provincial name of 'rubble' or 'brash' is given in many parts of England. It may be referred to the weathering or disintegration of stone on the spot,—the effects of air and water, sun and frost, and chemical decomposition."—See CORNBRAH.

Brattice.—In coal-mining, an underground wall or partition made of wood, or faced up with wood, to prevent the escape of gases or water, or to alter the current of ventilation.

Braunite (in honour of M. Braun of Gotha).—An abundant ore of manganese, consisting, according to analyses of Indian specimens, of 73.79 binoxide of manganese, 12.91 peroxide of iron, 8.30 silica, with magnesia, oxygen, and water.—See MANGANESE.

Brazilian Ruby.—The name given by lapidaries to light rose-coloured spinelle, and pink-coloured topaz.

Brazilian Sapphire.—The name given by some authors to light-blue topaz, and by lapidaries to indicolite.

Brazilian Tourmaline.—The name given by lapidaries to Brazilian emerald.

Breast.—A miner's term for the face or front of a coal-seam at which he is working. The term is also applied to the wooden partition that divides a shaft, from bottom to top, into two compartments—the one forming an "upcast" the other a "downcast" current of ventilation.

Breccia (Ital. a crumb or fragment).—A term applied to any rock composed of an agglutination of angular fragments, as "volcanic breccia," "osseous breccia," "calcareous breccia," &c. A *breccia*, or *brecciated rock*, differs from a conglomerate in having its component fragments irregular

and angular, whereas the pebbles of the latter are rounded and water-worn. The origin of many breccias and breccio-conglomerates is extremely puzzling to geologists. Many of them seem to point to the action of frost on exposed rock-surfaces, and to the transporting power of ground and river ice for their deposit in water; *e.g.*, the Permian Breccias of Devon and Annandale.

Breeze.—The general term for a wind of some briskness, but of limited extent and duration; less violent than a *gale*.

Breithauptite (after Professor Breithaupt of Freyberg).—Antimonial nickel; occurring in the Hartz with ores of cobalt, lead, zinc, and pyrrargyrite; either crystalline, arborescent, or disseminated; of a light copper-red, with a violet-blue tarnish; and consisting of 31.4 nickel, and 68.6 antimony.

Brewsterite (after Sir D. Brewster).—One of the Zeolite family, occurring in short prismatic crystals of a greyish white or yellowish colour and vitreous lustre, formed by several vertical prisms, and consisting of 54 silica, 17 alumina, 8.7 strontia, 6.4 baryta with lime, and 13.5 water.

Brewstoline (after Sir D. Brewster, by whom the first accurate researches were made into the nature of the liquids and gases which occur in the cavities of rock-crystal and other gems).—Brewstoline is a transparent, colourless fluid, occurring in the minute cavities of rock-crystal, amethyst, topaz, &c.; is thirty-two times more expandible than water, and is said to be liquid carbonic acid.—See **AMETHYSTOLINE**.

Brick-Clay.—The familiar term for any clay used in the manufacture of bricks, tiles, and the like. A good *brick-clay* consists of a tolerably pure silicate of alumina, combined with sand in various proportions, and free from lime and other alkaline earth, of which there ought not to be more than 2 per cent,—more than this acting as a flux in the brick-kiln. A little iron is also present in most varieties; hence the red colour of the bricks as the iron passes into the state of peroxide. Brick-clays are generally superficial deposits, but may also be obtained from any of the stratified formations.——In geological classification, the term "Brick-clay" is frequently used in contradistinction to that of "Boulder-clay"—meaning thereby those finely-laminated clays of the Pleistocene epoch which immediately overlie the true Boulder-clay, and have evidently been derived from it by the wasting and re-assorting agency of water.

Bristol-Stone, or Bristol-Diamond.—A familiar term for small brilliant crystals of quartz or rock-crystal, occurring in the limestones of Clifton, near Bristol.

Brittleness.—That quality of minerals and other solids by which they admit of being easily broken into fragments. The opposite of tough or tenacious: thus a substance may be *hard yet brittle*, be *soft and yet tenacious*.

Brocatello (Span).—A species of brecciated marble, the component fragments of which are of various colours—white, grey, yellow, and red. Brocatello is of Tertiary age, and makes a curious rather than an elegant ornamental stone.

Bromine (Gr. *bromos*, a stench).—One of the non-metallic elements, discovered by M. Balard of Montpellier in 1826. It occurs in the state of a deep-red liquid, having a fetid odour somewhat resembling chlorine, and is usually obtained from the uncrystallisable residuum of sea water called *bittern*. It is found, however, not only in sea water, but in several salt springs, as well as in certain marine plants and animals.

Bromite.—Bromic-silver, an ore of silver occurring in olive-green grains,

and consisting of 57.5 silver and 42.5 bromine. It is often mixed with carbonate of lead, peroxide of iron, and clay, and is found in the silver mines of Mexico and South America, where it is termed *verde plata*, or "green silver."

Bróngniartin (after Brongniart), known also as *Glauberite*.—A double sulphate of soda and lime—a rare salt, occurring in connection with rock-salt and clay.

Bróntes (Gr. *brontes*, a giant).—A genus of Devonian trilobites, especially characterised by their broad, radiating, fan-like tail, and so termed from their great size compared with the other genera of the family. Little is known of the true form of the head or disposition of the eyes.

Brontozóum (Gr. *brontes*, a giant, and *zoon*, an animal).—A provisional name given by Professor Hitchcock to certain gigantic bird-like footmarks discovered in the New Red Sandstone of Massachusetts and Connecticut. Some of these footmarks, as those of the *B. parallelum*, are fully 20 inches in length, with a corresponding breadth or divarication of the toes.—('Silliman's Journal' for 1847.)

Bronze (Fr.).—A well and anciently known alloy of tin and copper—the proportions of the admixture varying according to the purposes to which it was to be applied, and the hardness and toughness depending more on the mode of tempering than on the relative quantities of the ingredients. Ancient bronze usually contains from 4 to 15 per cent of tin. Modern bronze, when used for statues, medals, and the like, usually contains a small percentage of zinc and lead; but that for bells, cannon, and other articles subjected to great strain, is injured by such admixture. The best "gun-metal," it is said, consists of 91 copper and 9 tin; the best "bell-metal," of 78 copper and 22 tin.

Bronzite.—A variety of diallage or schiller-spar, so called from its metallic lustre and pinchbeck or clove-brown colour. It differs from diallage and schiller-spar in being less fusible, and also by its greater hardness and specific gravity.—See SCHILLER-SPAR.

Brookite (after Brooke).—Same as *Anatase*, which see; an ore of titanium occurring in rhombic prisms of a brownish-yellow or reddish colour, with a brilliant lustre inclining to metallic. Consists of oxide of titanium or titanic acid, with traces of iron peroxide and alumina.

Brown Coal.—Another name for Tertiary lignite, in allusion to its colour, as distinguished from the clear, shining, or crystalline black of true coal. "Wood-coal," "bituminous wood," and "board-coal," are occasional local synonyms.—See LIGNITE.

Brown Spar.—Siderite, sphærosiderite, or sparry carbonate of iron; an abundant ore of iron, consisting generally of from 50 to 60 per cent of iron protoxide, and from 30 to 40 carbonic acid, with traces of lime, manganese, and other minor impurities. The name is also given to the brown crystallised varieties of Dolomite, whose colouring matter is derived from a small percentage of iron.—See IRON.

Brucite (after Dr Bruce of New York, by whom it was discovered and described).—A native hydrate of magnesia, consisting of 69 magnesia and 31 water; a synonyme also given to *Condrodite* or *Chrysolite*, which consists of silica, magnesia, fluorine, and iron.

Bruckmannia (after Bruckmann).—Count Sternberg's term for certain closely-jointed stems with verticillate leaves which occur in the Coal-measures, now ranked under the general head ASTEROPHYLLITES.

Bryozoa (Gr. *bryos*, moss, and *zoon*, animal).—This term embraces all the minute mollusca which inhabit compound structures, and which were formerly regarded as zoophytes or corallines—*e.g.*, *retepora*, *fenestella*, *polypora*, &c. The term (introduced by Ehrenberg) has reference to their branched and moss-like aggregation.—See POLYZOA.

Bubalus (Lat. a buffalo).—Remains of the Musk-buffalo (*B. moschatus*), a well-known living inhabitant of arctic regions, have been found in the glacial drift of England, Germany, and other European localities—thus indicating the climatal conditions that prevailed over these latitudes during the close of the Tertiary period.—See BOVIDÆ.

Bucholzite (after Bucholz, the German chemist).—Known also as fibrolite; a term for the finely-fibrous varieties of *Andalusite* or *Sillimanite*, which see.

Bucking (in mining).—Crushing ore. A *bucking-iron* is the tool (a flattish hammer) with which the ore is crushed by the hand; a *bucking-plate* is the plate on which the ore is bucked.

Bucklandite (after Dr Buckland).—A variety of epidote or prismatic augite-spar, occurring in small black vitreous crystals in the granitic rocks, and described as a pure iron epidote.

Buddle (in mining).—A pit, trough, or frame filled with water, by means of which ores are separated from earthy substances by washing.

Bufo (Lat. *bufo*, a toad).—Literally toad-stone; a name given to the fossil teeth and palatal bones of fishes belonging to the family of *Pycnodonts* (thick-teeth), whose remains occur abundantly in the Oolitic and Chalk formations. The term *bufo*, like those of “serpent’s eyes,” “batrachites,” and “crapaudines,” by which they are also known, refers to the vulgar notion that those organisms were originally formed in the heads of serpents, frogs, and toads.

Bumastus (Gr. a bunch of large grapes—literally each large as a cow’s nipple, *bou* and *mastos*).—A genus or sub-genus of Silurian trilobites, so called from their oblong-oval or grape-like form, and known to collectors as the “Barr Trilobite,” from their plentiful occurrence in the limestone of Barr, in Staffordshire. In *bumastus*, which may be regarded as a sub-generic form of *Ilænus*, the general form is oblong-oval and very convex; the head, thorax, and abdomen are of nearly equal length; the head and tail plates much rounded; the eyes smooth and not granulose; the thorax of ten narrow segments, in which the trilobation is scarcely discernible; and in most species the crust studded with minute punctures.

Bunch.—A miner’s term for an irregular lump of ore—more than a stone, and not so much as a continuous vein. A mine is said to be *bunchy* when the yield is irregular—sometimes rich, sometimes poor.

Bunter (Ger. variegated).—The German term for the New Red Sandstone of English geologists, in allusion to its variegated colour; the lowest group of the TRIASSIC SYSTEM, which see.

Byrrhætis.—A genus of coleopterous insects remarkable for their brilliant metallic tints; chiefly inhabitants of warm and intertropical climates, and frequenters of woods and pine-forests. Their *elytra* or wing-sheaths have been long known in the Oolitic flags of Stonesfield, near Oxford.

Burdiehouse.—About three miles south from Edinburgh, situated on the Lower Coal-measures, and celebrated for its estuary or fresh-water limestone, which has yielded many fine fishes (*palæoniscus*, *amblypterus*, *megalichthys*, *rhizodus*, *holoptychius*, &c.), and beautifully preserved plants, as

sphenopterus, calamites, asterophyllites, stigmara, lepidodendron, lepidostrobus, &c.—See Dr Hibbert's paper in 13th vol. 'Trans. Royal Soc. of Edinburgh,' and Page in 'Brit. Assoc. Reports' for 1855.

Burr or **Burr-Stone**.—A name given to certain siliceous or rather siliceo-calcareous rocks, whose dressed surfaces present a *burr* or keen-cutting texture; hence their use as millstones. The most esteemed varieties are obtained from the upper fresh-water beds of the Paris basin, and from the Eocene strata of South America. The French burrs are porous, or rather vesicular, in texture, and of a whitish or cream colour. They are extensively used in this country.

Byssolite (Gr. *byssos*, fine flax, and *lithos*).—A somewhat indefinite term applied to fine fibrous varieties of amianthus, tremolite, actinolite, and other filamentous minerals. The *Byssolith* of Hausmann is a fine, transparent, azure-coloured variety of actinolite, consisting, according to Dufrénoy, of 26.98 oxide of zinc, 4.17 oxide of copper, 26.69 lime, and 39.16 water and carbonic acid.

Byssus (Gr. *byssos*, fine flax).—In conchology, the fine silky filaments by which the pinna, mussel, and other bivalves attach themselves to the rocks and sea-bottom. In botany, the silky tufts of mould or fungus-growth which spring from damp and decaying substances.

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Cabocle.—The name given in Brazil to a compact brick-red mineral found in the diamond sand of the province of Bahia. It resembles jasper, but contains phosphoric acid, alumina, lime, and water.

Cáchalong.—A milk or bluish white variety of opal, so called from its being found in great beauty on the borders of the river Cach in Bucharia. In the Kalmuc language, *cholong* is said to signify a precious stone. According to Forchammer, a cachalong from the Farø Islands yielded 95.32 silica, 3.47 water, iron peroxide a trace, .07 potash, .06 soda, .06 lime, .40 magnesia.—See OPAL.

Caddis-Worms or **Case-Worms**.—The larvæ or grubs of the trichopterous (hairy-winged) insects, and so called because they are enclosed in a case or sheath, composed of agglutinated extraneous substances, such as fragments of straw, twigs, shells, &c. Some pass their larval state under water (e.g., the May-flies), and are thus sometimes found fossil in such masses as to constitute layers of fresh-water limestone.—See INDUSTRIAL LIMESTONE.

Câdent (Lat.).—Falling; the tenth of the fifteenth series into which Professor Rogers subdivides the Palæozoic strata of the Appalachian chain—the "Declining Day" of the North American Palæozoics, and the equivalent of our Lower-Middle Devonian.—See tabulations, "GEOLOGICAL SCHEME."

Cadmium.—A bluish-white metal, discovered in 1818 by Stronmeyer and Hermann in several of the ores of zinc, and named from *cadmia fossilis*, an old term for zinc ore. Cadmium greatly resembles tin in appearance, but it is harder than that metal; it is ductile and malleable; melts a little be-

low 500° Fahr., or under a red-heat, and is about as volatile as mercury. Its scarcity prevents its use in the arts, but its oxide has been used as a pigment.

Caen Stone.—The French equivalent of our "Great or Bath Oolite," an Oolitic limestone so termed from its being extensively quarried in the neighbourhood of Caen in Normandy, where it is developed in thick nearly horizontal beds. As a building-stone it is of admirable quality; soft in the quarry, of a delicate uniform cream colour, and extreme fineness of texture, but hardens on exposure, and is found to be exceedingly durable.

Cainozoic or Cænozoic (Gr. *kainos*, recent, and *zoe*, life).—Applied to the upper stratified systems holding recent forms of life, as distinguished from *Mesozoic* (holding intermediate) and *Palæozoic* (holding ancient and extinct forms). As a paleontological division, the Cainozoic embraces the Tertiary and Post-Tertiary systems of British geologists.—See tabulations, "GEOLOGICAL SCHEME."

Cairngorm.—A brownish-yellow or amber-coloured variety of rock-crystal, so called from its being found in great perfection in the Cairngorm Mountains, Aberdeenshire. "It was formerly much valued," says Professor J. Nicol, "for ornamental purposes, and an Edinburgh lapidary cut nearly £400 worth of jewellery out of a single crystal."—See QUARTZ.

Caithness Flags.—A well-known series of dark-coloured bituminous flaggy beds, slightly micaceous and calcareous, of great toughness and durability, and largely employed for paving. They belong to the lower-middle portion of the Old Red Sandstone as developed in Scotland, and are celebrated for their abundance and variety of fossil fishes—as *coccosteus*, *pterichthys*, *diptherus*, *diplopterus*, *cheiracanthus*, *asterolepis*, &c.—See AGASSIZ, 'Poisons Fossils des Vieux Grès Rouge,' and Miller's 'Old Red Sandstone.'

Caking Coal.—The name given to certain varieties of bituminous coal, which, like those of the Newcastle coal-field, cake or run together in the act of combustion.—See COAL.

Célaite.—A mineralogical term for the *turquois*, from its being supposed to be the precious stone alluded to by Pliny under the name of *Callais*.

Calamine.—The common name for the carbonate of zinc, which occurs, massive or crystallised, in beds and veins in the crystalline and transition rocks, and also in the Carboniferous and Oolitic formations. It is most abundant in limestone, and is often associated with calc-spar, quartz, blende, and ores of iron and lead. The name is said to be derived from *calamus*, a reed, because during the process of smelting it adheres to the bottom of the furnace in the form of reeds.

Calamites (Lat. *calamus*, a reed).—A genus of fossil stems occurring abundantly in the Coal-measures, and so termed from their resemblance to gigantic reeds. Their true affinities, however, are not well known, and all that can as yet be said of them is, that they were tall hollow articulated stems, furnished with leaves or branches at the joints, possessing a distinctly separable wood and bark, and readily disarticulating at the nodi. The surface of their wood was marked with numerous parallel furrows, which gives to the fossil stems their striated or channeled appearance; the leaf or branch scars are observable at all the joints, and their substance seems to have been so soft as to offer little or no resistance to pressure. According to some, they seem analogous to reeds, but this opinion is not well founded. Brongniart would ally them to the equisetums; but Lindley and others regard their true affinities as yet undiscovered. This much seems

certain, that they were both numerically and specifically abundant ; that their habitat was the soft marshy silt of the river edge and estuary ; and that they contributed largely to the formation of our coal-seams.

Calamodendron (*calamus*, a reed, and *dendron*, tree).—Literally “reed-tree ;” one of Brongniart’s genera of Coal-measure plants, often of considerable thickness, and having their surfaces or outer barks smooth, their stems solid, and containing a deeply striated, articulated, reed-like pith ; hence the name. Their real nature and affinity to the ordinary *calamite* are by no means satisfactorily determined.

Calamophylla (*calamus*, a reed, and *phyllon*, a leaf).—A genus of Mesozoic or Oolitic corals, so called by Milne Edwards from their being composed of masses of radiating tubes, with striated reed-like surfaces. Individual masses have been found several feet in diameter—the progeny, like the existing brain-coral, of a single germ. Known also as *EUNOMIA*.

Calcaire Grossier (Fr., literally coarse limestone).—An important member of the Eocene beds of the Paris basin ; usually co-ordinated with the Barton, Bagshot, and Bracklesham beds of the English Tertiaries.

Calcaire Siliceux.—A designation of the French geologists for a compact siliceous limestone of the Paris basin, which sometimes takes the place of the *Calcaire Grossier*.

Calcareous (Lat. *calx*, *calcis*, lime).—Composed of or containing a considerable portion of lime. Thus we speak of *calcareous spar* or *Calcite*, which is a pure carbonate of lime, and of *calcareous shale* or *calcareous sandstone*, which only contain a portion of lime. Geologists also compound the term, as *calcareo-argillaceous*, *calcareo-siliceous*, &c.

Calcariferous.—Literally “lime-yielding.” A term occasionally applied to springs charged with carbonate of lime, and which on issuing into the air deposit incrustations of calcareous tufa. The “petrifying springs” of ordinary language.

Calcedony (Lat. *calcedonius*, found at Calcedon, in Bithynia).—A semi-transparent siliceous mineral, of the quartz family, closely allied to the opal and agate, and often found associated with them in geodes and vein-bands. It is usually uncrystallised, of a uniform milky-white or pale yellow, and, when occurring as an incrustation or sinter, has a wavy internal structure and peculiar mammillated surface.

Calceola (Lat. a little shoe or slipper).—A fossil brachiopod, so called from its under or ventral valve, which is flatly conical, or compressed like the point of a shoe, and fitted with an opercular or lid-like upper valve. It is characteristic of the Middle Devonian period, and so abundant in the schists underlying the Eifel limestone, that these are known to German geologists as “*Calceola-schiefer*.”

Calcliferous (Lat. *calx*, lime, and *fero*, I bear).—Producing or containing lime ; applied to groups of strata containing subordinate beds of limestone ; e.g., “calcliferous grits,” “calcliferous sandstones”—the latter term being usually applied to the Lower Coal-measures in the neighbourhood of Edinburgh, after Mr C. Maclaren, who first made use of the designation ; the equivalents of the Carboniferous slates of the Irish geologists.

Calcine (Lat. *calx*, *calcis*, lime).—To reduce a substance, by heat, to a calx or friable state, by the expulsion of some volatile matter either combined with it or forming its cementing principle, as the carbonic acid from limestone, or the water of crystallisation from salts. To oxidise as a metal ; to reduce to a metallic calx. **Calcination**.—The process of reducing any ore

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or mineral to a calx by the application of heat. Thus chalk by burning is reduced to *quicklime*, and gypsum to *plaster-of-Paris*.

Calcite (Lat. *calx*, lime).—A common mineralogical term for the crystallised varieties of carbonate of lime, which are known also as *Calcareous* or *Calc-spar*, which see. The calcites are among the most universally diffused of mineral crystals.

Calcium (Lat. *calx*, quicklime).—The metallic basis of lime, originally discovered by Sir Humphrey Davy in 1808. It is a whiter metal than strontium and barium, and is extremely oxidable, rapidly becoming the *protoxide*, or quicklime, on exposure to the atmosphere.

Calc-Sinter (Ger. *sinter*, to drop).—This term is usually applied to compact stalagmitical or stalactitical deposits from calcareous waters. The gradual increment of calc-sinter is usually marked by lines or layers of varying hardness and colour.—See **SINTER** and **CALC-TUFF**.

Calc-Spar or Calcareous Spar.—The general term for crystallised carbonate of lime or *calcite*, which occurs in a vast variety of forms, and in various degrees of purity—from the pure pellucid rhombs of *Iceland spar* to the confusedly crystalline aggregates of the ordinary marbles. The primitive crystal of calc-spar is rhombohedral, with obtuse angles of $105^{\circ} 8'$ and $74^{\circ} 52'$. The derivative forms and combinations are said to exceed 800; they are all easily cleavable, and when irregular are readily distinguished from quartz by being easily scratched, or by effervescing under acids. Calc-spar, in its purest form, consists of 44 carbonic acid and 56 lime; or 40 calcium, 12 carbon, and 48 oxygen.—See **LIMESTONE**.

Calc-Tuff or Calcareous Tufa.—A porous or vesicular carbonate of lime, generally deposited near the sources and along the courses of calcareous springs, incrusting and binding together moss, twigs, shells, and other objects that lie in the way. Occasionally, when such springs discharge themselves into lakes and seas, beds of considerable thickness are formed, producing a light calcareous rock like the *travertins* of Italy. When slowly formed in the open air, compact incrustations are the usual result, and these are known by the name of *calc-sinter*. In these calcareous springs, commonly known as “petrifying springs,” the lime is held in solution by an excess of carbonic acid, or by heat, if it be a hot spring, until the water in issuing from the earth cools or loses part of its acid, and then the calcareous matter is precipitated in a solid state.—See **TRAVERTINE**.

Caldéra.—A Spanish term for the deep caldron-like cavities which occur on the summits of extinct volcanic mountains and islands, and evidently the extinguished craters of ancient volcanoes.

Calédonite.—A mineralogical term for a cupreous sulphato-carbonate of lead, occurring in long prismatic crystals, or in acicular tufts of a fine verdigris or mountain-green; transparent or translucent, and having a resinous lustre; consists, according to Brooke, of 55.8 sulphate of lead, 32.8 carbonate of lead, and 11.4 carbonate of copper. So called by Beudant from its being found at Leadhills in Scotland (Caledonia).

Calliard (Gr. *challis*, Fr. *caillon*, a flinty pebble).—A local name for any hard siliceous stone; often applied by English miners and quarrymen to beds of cherty or siliceous limestone.

Callimus.—The name given to the loose and movable central core of the *Astites*, or *Eagle-stone*, which see.

Calomel (Gr. *kalos*, fair; *melas*, black or Ethiops mineral).—Chloride of mercury (15.1 chlorine and 84.9 mercury), a rare mineral, occurring in the

quicksilver mines of Europe in pyramidal crystals or tubercular crusts, of a greyish-white colour, occasionally translucent, and sectile. A preparation of mercury (the submuriate or dichloride), much used in medicine.

Calp.—A provincial Irish term for an impure argillaceous limestone, or rather argillo-ferruginous limestone; hence the name *Calp-slates*, adopted by Mr Griffiths for a considerable thickness of shale, argillaceous limestone (calp), and flaggy sandstone, which occurs between the two great bands of Carboniferous limestone, as developed in Ireland. The *Calp-slates* lie above the lower band, the *Carboniferous slates* beneath it.

Calymène (Gr. *kekalymene*, concealed, obscure.)—A genus of trilobites deriving its name from the obscurity which long hung over the real nature of these crustaceans; the "Dudley Trilobite" or "Dudley Locust" of collectors. The genus occurs throughout the Silurian system, but more especially in the Ludlow rocks of England, and is distinguished by its ovate, convex, and deeply-trilobed shell or crust, which is found either expanded or coiled up like the *onicus* or wood-louse. The common *Calymene Blumenbachii*, or "Dudley Trilobite," is found from one to five inches in length; has the head or cephalic shield large, convex, rounded in front with a well-marked border, boldly three-lobed, and having the two compound faceted eyes set widely apart on the sides of the shield; the thoracic portion consists of thirteen segments, and the pygidium or tail-plate is small and nearly semicircular.

Cámbrian (*Cambria*, the ancient name for Wales).—Belonging to Wales. In geology, a term employed by Professor Sedgwick to designate the lowest fossiliferous rocks as developed in North Wales. As originally employed, the term embraced several series of strata (the Caradoc or May Hill sandstone, the Llandeilo flags, and the Bala limestone) which have since been ranked as *Lower Silurian*. As now received by geologists, the "Cambrian System" embraces the Lingula flags of North Wales, the Stiperstones of Shropshire, the lower Greywacke of the south of Scotland, and the lowest fossiliferous rocks of Wicklow in Ireland, and is regarded as the equivalent of the *Huronian System* of North America, which see.—See also tabulations, "GEOLOGICAL SCHEME."

Camélidæ (Lat. *camelus*, a camel).—The Camel family, which includes the true camels of the eastern hemisphere and the llamas of the western. They are the only ruminants having incisors in the upper jaw, and are now a limited family, though remains of an extinct species have been found in the Tertiaries of the Siwalik hills in India, and of allied genera, such as *Sivatherium* from the same deposits, and *Macrauchenia* from the later Tertiaries of South America.

Cámeo (It. *cameo*).—A precious stone engraved in relief, as opposed to an *intaglio*, which is cut into the stone. The earliest cameos appear to have been cut upon the onyx, and subsequently upon the agate. The true cameo is formed upon a stone of two or more layers differing in colour, and the art of the engraver consists in so cutting as to appropriate these different coloured layers to distinct parts or elevations of the figure to be produced. Porcelain and glass have been employed with indifferent success as a substitute for the natural gems; and the shells of various mollusca are now chiefly used to produce cheap and not inelegant imitations.

Campylodiscus (Gr. *kampylos*, bent, and *discos*, a quoit or disc).—A genus of Tertiary infusorial organisms; so called from their form, which is that of an oval disc, somewhat incurved or bent inwards upon itself.

Their siliceous shields occur in profusion in the tripoli or polishing-slate of Bohemia and other regions.

Cancellated (Lat. *cancelli*, a grating of bars, lattice-work).—Latticed; anything which is cross-barred, or marked by lines which cross each other at right angles. This cancellated arrangement is common in leaves, in bones of certain mammals, in the bryozoa, and other organic structures.

Cangána (Span.).—A South American term for the volcanic mud of the Quitenian Andes. This mud is compact, slightly argillaceous, and more or less saline, and occurs in rock-like masses, yielding very slowly to atmospheric agency, or even to running water.

Cánine, Canines (Lat. *canis*, a dog).—Dog-like; partaking of the nature of, or exhibiting the characteristics of, the Dog tribe. The “canines” or canine teeth in mammals are those strong, sharp-pointed teeth (one on each side in either jaw), inserted between the incisors and premolars; and are so termed from their well-marked development in the dog, for whom, as for other animals possessed of them, they perform the function of cutting and tearing.—See **TEETH**.

Cannel Coal.—A compact, brittle, jet-like variety of coal, sonorous when struck, breaks with a conchoidal fracture, and does not soil the fingers when handled. It is said to derive its name from the candle-like light it yields when burning; and is known to the Scotch miners as “parrot-coal,” from the crackling, chattering noise it emits when first thrown into the fire. It occurs interstratified in the Coal-measures of certain districts along with ordinary coal, and often forms, in the Scotch coal-fields, the upper portion of a seam of splint-coal, or even of a bed of black-band ironstone. Occasionally these ironstones become so bituminous as to pass into a cannel coal more or less pure; and *vice versa*, a cannel coal often becomes so ferri-ferous as to afford an available ironstone. Cannel coal appears to have been formed either by the greater maceration of the vegetable mass, or under such conditions as permitted a more equable and thorough bituminisation than in ordinary coal. It is used chiefly in the manufacture of gas, for which it is admirably fitted; and some of the more lustrous and tougher varieties are worked, like jet, into ornaments and curiosities.

Cañons (Span.).—The name given in western America to the profound gorges or river-channels that occur in the region of the Rocky Mountains. Many of these chasms (*e.g.*, those of the Colorado) are wall-sided and cut through stratified rocks as well as granites to the enormous depth of 3000 and 4000 feet.

Cantalite.—A variety of pitchstone containing crystals of glassy felspar, of a green colour, slightly translucent, and so named from its occurring in the Cantal.

Capillary (Lat. *capillus*, a hair).—Hair-like. Applied to amianthus, certain zeolites, and other minerals whose crystals occur in filaments or fine hair-like masses; also to fine tubes less than the twentieth of an inch in diameter, and capable of sustaining or attracting any liquid considerably above the level at which they may be immersed. This *capillary attraction*, as it is termed, is a phenomenon which occurs less or more in all porous bodies—the minute interstices acting as capillary tubes, and “drawing” or “attracting” any liquid considerably above the level of its mass.

Caradoc Sandstone.—The upper member or series of the “Lower Silurian” formation, as it occurs in the hilly range of Caer Caradoc in Shropshire, from which it takes its name (*Caractacus*, king of the ancient

Britons, corrupted Caradoc). In the typical district, the Caradoc group consists of sandy shales, courses of shelly sandstone occasionally passing into bastard limestone, and light-coloured siliceous sandstones and grits. They are worked as freestones; and notwithstanding their soft and sectile character, these Caradoc sandstones are laden with a profusion of fossils of the same species as occur in the slaty argillaceous rocks of large tracts of Wales—*e.g.*, Snowden and Bala.—See SILURIAN SYSTEM.

Cárapace (Gr. *karabos*, a crustaceous animal like the crab and lobster).—A general term for the crustaceous and horny coverings of certain classes of animals, which, like the plates of the armadillo, the horny shell of the tortoise, and the calcareous crusts of the crab, protect the internal parts from injury, and become, as it were, a sort of external skeletons. The term, however, is mainly applied to the shields of the tortoises, crustacea, and infusorial animalcules.

Carbon (Lat. *carbo*, the inflammable matter forming charcoal).—Carbon is one of the elementary substances, and in its pure form exists only in the diamond. By combustion in oxygen it forms carbonic acid gas. In its impure or mixed forms carbon occurs largely in nature, as in the substance of all wood plants; in the tissues of animals; and abundantly in many minerals, as in the coals, bitumens, mineral resins, &c.

Carbonaceous (Lat. *carbo*, coal).—Coaly; applied to rocks containing abundant traces of fossil carbon, or vegetable debris; hence “carbonaceous shales,” “carbonaceous sandstones,” &c.

Carbonate.—In chemistry, any compound of carbonic acid with a base; as carbonate of lime, carbonate of iron, &c.

Carbónic Acid.—An acid formed by the chemical union of carbon and oxygen. It is the gas given off during the effervescing of soda-water, champagne, and other similar liquids. It occurs largely in nature, being given off by volcanic vents, by fissures in mines, caves, and wells, by many mineral waters, by the respiration of animals, and during the decay of vegetable substances. It is an essential ingredient of all calcareous rock-masses (carbonate of lime), and an active agent of disintegration, whether combined with the atmosphere or with the waters that deeply percolate the rocky strata.

Carboniferous (Lat. *carbo*, coal, and *fero*, I bear).—Coal-bearing; coal-yielding. The term is usually applied to that system of Palæozoic strata from which our main supplies of coal are obtained, or to the respective groups or members of that system; hence we speak not only of the “Carboniferous system,” but of the “Carboniferous limestone,” the “Carboniferous slates,” and so forth.

Carboniferous System.—That formation, or system of fossiliferous strata, which, in order of time, succeeds the Old Red Sandstone, and is in turn surmounted by the Permian or New Red Sandstone of the earlier English geologists. As a system, it constitutes the younger or upper portion of the Palæozoic cycle, and derives its importance from being, in Britain, North America, and other countries, the great repository from which are obtained the chief supplies of COAL, so indispensable to the industrial arts and manufactures of modern civilisation. *Lithologically*, the system consists of alternations of sandstones, shales, clays, limestones, coals, and ironstones, in every degree of admixture and purity, and of every condition of formation—terrestrial, fresh-water, estuary, and marine. *Palæontologically*, there have been discovered in its strata representatives of all

the great forms of life, with the exception, perhaps, of true dicotyledonous plants in its flora, and of birds and mammals in its fauna. As its name implies, the most striking peculiarity in the formation is the profusion of fossil vegetation, which marks less or more almost every stratum, and which in numerous instances forms thick seams of solid coal. Although this *coaly* or *carbonaceous* aspect prevails throughout the whole, it has been found convenient to arrange the system into three groups—the Lower Coal-measures or Carboniferous Slates, the Mountain or Carboniferous Limestone, and the Upper or True Coal-measures; or more minutely, as is generally done by British geologists, into—

1. Upper Coal-measures.
2. Millstone Grit.
3. Mountain Limestone; and
4. Lower Coal-measures.

Other subdivisions have been attempted according to the local peculiarities of different coal-fields; but it is enough for the purposes of the general reader to know, that all these minor arrangements can be readily co-ordinated with one or other of the above four series. Thus Sir R. Griffiths, in his Geological Map of Ireland, gives the annexed subdivisions:—

a. Coal-measures, upper and lower,	1000 to 2200 feet.
b. Millstone Grit,	350 „ 1800 „
c. Mountain Limestone, upper, middle, and lower,	1200 „ 6400 „
d. Carboniferous Slate,	700 „ 1200 „
e. Yellow Sandstones (of Mayo, &c.), with shales and limestones,	400 „ 2000 „

Now, here there is this little difficulty in co-ordinating, as we have first the usual members of the system, *a*, *b*, *c*, and *d*, and a subjacent series, which lies fairly open to the question whether it is not the equivalent of the “yellow sandstones” which form the uppermost portion of the Old Red Sandstone or Devonian system in other localities. Again, the Carboniferous strata of the south of England (on the Avon near Bristol) are given in the ‘Geological Survey’s Memoirs’ as consisting of:—

- a. Millstone Grit—here mostly a hard reddish grit-stone, the grains often almost confluent, as in what are called quartzites and quartz-rocks, . . . 950 feet.
- b. Alternations of Limestone, red or grey, compact or granular, with shales, red, dark, or grey, and sandstones. Most of the strata fossiliferous, and *Producta gigantea* abundant near the base, . . . 400 „
- c. Scar Limestones—grey, reddish, mottled, brown, and black; compact, shelly, crinoidal, and oolitic, in beds varying in thickness, and partially divided by shales, . . . 1440 „
- d. Lower Series, enclosing many alternations of limestones and shales, the former often black, brown, yellowish, sometimes impure, and in one part charged with fish-remains and cyprides in abundance, . . . 500 „

* * The upper part of the Old Red shows yellow and grey sandstones and marls.

In this case there can be no difficulty in at once assigning *b* and *c* to the great series of the Mountain Limestone; while *d* is evidently the equivalent

lent of the "Lower Coal-measures" of Scotland, with a few of its beds graduating, it may be, into the yellow sandstones of the underlying Devonian. In Fifeshire, on the other hand, we have—

- a. True Coal-measures—consisting of numerous alternations of coal, shales, sandstones, ironstones, and occasional beds of impure limestone, 2500 feet.
- b. Several strata of crinoidal and producta limestone, with intervening beds of shale, sandstones, and thin seams of coal, 300 , ,
- c. A vast thickness of whitish fine-grained sandstones, bituminous shales, a few thin seams of coal, mussel-bands or shell-limestone, and fresh-water limestones abounding in cyprides, 2000 , ,

In this instance there is no development of Millstone Grit—the whole system resolving itself, as it does in many other regions, into Upper Coal, Mountain Limestone, and Lower Coal. In Nova Scotia, again, we have in the lower series a vast development of gypseous beds, which look somewhat puzzling at first sight to an English geologist; but which, when taken in connection with the associated shales and coals and fossils, admit of easy co-ordination on the large scale with the main subdivisions established by British geology. How far these subdivisions may indicate separate life-periods, or only portions of one great epoch, has yet to be determined by a more minute and rigorous comparison both of vegetable and animal species. In the mean time, existing evidence rather favours the latter opinion, and geologists are nearly at one in regarding the Carboniferous system as a great life-period, characterised from all others by many forms of a varied marine and estuary fauna—its gigantic sauroid fishes, crustaceans, encrinurites, and corals; but in particular by the vast profusion of its endogenous flora—its *stigmaria*, *sigillaria*, *lepidodendra*, *favularia*, *Knorria*, *bothriodendra*, *ulodendra*, *calamites*, *asterophyllites*, and *filicites*—plants which rose, culminated, and died out with the period, never again to be repeated in the onward phases of vegetable development.

Carbuncle (Lat. *carbunculus*, a little coal, from *carbo*).—The name given by jewellers to the variety of precious garnet (*Pyrope*) which is set *en cabochon*. It is of a deep red colour, with a mixture of scarlet, and when held up to the sun becomes exactly of the colour of a burning coal.

Carcharodon (Gr.)—Literally "jagged tooth;" a genus of Tertiary sharks, so termed from their notched or jagged teeth, which are often of great size, and indicating dimensions more than double that of the largest existing species. The living genus *Carcharias* comprises the large sharks with cutting triangular teeth, crenated or notched on their margins, and having a broad base. In the extinct *Carcharodon* the teeth differ from those of *Carcharias* in being solid in the centre, while in the latter they are hollow; but in both genera the teeth exhibit the same reticulated structure of medullary and calcigerous tubes.

Carcharopsis (Gr.)—Literally "shark-like;" a genus of Carboniferous shark-like fishes, founded by Agassiz on their teeth—the only portions yet discovered. These teeth occur in the Carboniferous Limestone; are compressed, triangular, crenated on the edges, with large plaits or folds in the enamelled surface, towards the base of the crown.

Cardiglio Marble.—A grey, clouded variety of marble obtained for ornamental purposes from the island of Corsica.

Cardinal (Lat. *cardo*, a hinge).—A term implying importance, and suggestive of the hinge or point on which a thing turns or depends. Thus the *cardinal points* of the compass are the North, South, East, and West; the *cardinal signs* of the zodiac, Aries, Cancer, Libra, and Capricorn.

Cardiocárpou (Gr. *kardia*, the heart, and *karpou*, fruit).—A genus of small heart-shaped seeds occurring in groups on the shales of the Coal-measures as if they had grown in clusters. Supposed by Brongniart to be *Lycopodiaceous*; by others, to have fallen from some species of *Asterophyllites*; and by Lindley, to have, like other genera of the Coal era, no very positive modern analogy.

Cárdium (Gr. *kardia*, the heart).—The cockle-shell, so named in allusion to its heart-like form; a well-known dimyarian bivalve occurring in many specific forms, both recent and fossil, in almost every sea, and from the Lias upwards. The cockle-like bivalves occurring in palæozoic formations are *Cardiola*, *Cardiomorpha*, and similar provisional genera: *Cardia*, *Cardinia*, *Cardilia*, &c., are chiefly mesozoic and neozoic forms, and belong to the family CYPRINIDÆ.

Carnelian (Lat. *caro*, *carnis*, flesh).—Applied originally to a flesh-coloured variety of calcedony; but now a lapidary's term for the more transparent varieties, whether brown, blood-red, yellow, white, or almost black. Carnelian is uniform in colour, or it may be less or more clouded, but it is never figured or striped like the agates. The colouring matter seems to be peroxide of iron, which may be acted upon by heat so as to convert specimens originally yellow into a fine deep red, as is done with those found at Cambaya, near Surat. The finest carnelians are found in India, Arabia, Surinam, and Siberia; but fair specimens are also obtained from Bohemia, Saxony, and Scotland. According to Heintz, a Chinese variety yielded—silica, 99.37; alumina, .081; iron peroxide, .050; magnesia, .028; potash, .004; soda, .075; carbon, .008; and water, .391.

Carnivora (Lat. *caro*, *carnis*, flesh, and *voro*, I devour).—One of Cuvier's orders of the mammalia (hyæna, tiger, &c.), so called from their subsisting solely on flesh. **Carnivorous**.—Living on flesh, in contradistinction to *herbivorous*, *frugivorous*, &c.—See tabulations, "ANIMAL SCHEME."

Carpolithes (Gr. *carpos*, fruit, and *lithos*, stone).—The general term for fossil fruits, such as those found in the Tertiary clays of the London basin, in the Coal shales of Newcastle, &c.

Carrára Marble.—A pure white, semi-transparent saccharoid marble obtained from the mountains of Massa Carrara in Italy, and highly valued for statuary purposes. It is an altered or metamorphic limestone of the Oolitic period.

Caryócaris (Gr. *karyon*, a nut, and *karis*, shrimp).—A small crustacean, from the Lower Silurian slates of Skiddaw, having a long, pod-shaped, bivalved carapace, rounded anteriorly, sub-truncate behind, and with the back and front sub-parallel. The surface is smooth, or with only oblique wrinkles near the margins, but with no parallel lines of sculpture. Body, telson, and appendages unknown.

Caryophýllia (Gr. *karyophyllon*, a clove).—Literally "clove-shaped;" a genus or section of lamellated Anthozoarian corals occurring from the Upper Silurian to the Chalk inclusive. The polyparium or calcareous axis is turbinated or cylindrical, simple or branched, longitudinally striated, fixed at the base; the cells boldly lamellated.

Cascade (Fr. from Ital. *cascare*, to fall).—A waterfall; usually applied in

geography to waterfalls on streams and rivulets, in contradistinction to the falls or cataracts on larger rivers.

Cascalho (Span.)—The name given in Brazil to the auriferous or gold-bearing detritus of the country. "The common cascalho," says Ansted, "is an indurated soil in which gold is contained, and seems to consist of the fragments of veins which have been by some means broken up, rolled about by the action of water, and buried by it among the clays which have composed its bed." The cascalho is also the principal repository of the Brazilian diamonds.

Cassiterite (Gr. *kassiteros*, tin).—A mineralogical term for the oxide of tin, or ordinary tin-ore, which consists of 79 tin and 21 oxygen, but often mixed with impurities of iron peroxide, silica, manganese, and the like. Most of the tin of commerce is derived from this ore.

Castoroides (Gr. *kastor*, beaver, and *eidos*, like).—A large rodent allied to the beaver and capybara, and found, along with the remains of mastodon, in the post-glacial deposits of North America; e.g., the *Castoroides Ohioensis* of Foster and Wyman.

Cátaclysm (Gr. *kataklysmos*, inundation).—Any violent flood or inundation that overspreads or sweeps over a country; deluge; debacle. **Cataclysmal**.—Applied to the effects or destructive power of such violent inundations.

Caténipóra (Lat. *catena*, a chain, and *póra*, cell).—Chain-pore coral; a genus peculiar to palæozoic strata, and so termed from the chain-like arrangement of its pores or cells in polished specimens. In *catenipora* the polyparium is hemispherical, composed of vertical anastomosing lamellæ; cells tubular, oval, terminal, and united laterally, so that in transverse sections they present a chain-like arrangement. Often found in hemispherical masses more than a foot in diameter. Known also by the Greek synonyme, *Halysites*, which see.

Cat's-Eye.—A variety of chalcedonic quartz, of a greenish-white or grey, olive-green, red, brown, or yellow colour, and containing parallel fibres of amianthus, which produce a peculiar play of light; hence the name. For this peculiar play of light the French use the term *chatoyant*. The finest varieties of this mineral are brought from Ceylon and Malabar.

Catlinite (after Catlin, the American traveller).—A reddish variety of claystone from the Côteau des Prairies, west of the Mississippi, which is carved into tobacco-pipes by the North American Indians.

Caudal (Lat. *cauda*, the tail).—Belonging to or connected with the tail; as "caudal fin," the tail fin; "caudal vertebræ," vertebræ of the tail.

Caudex (Lat. *caudex*, a stem or stock).—In botany, usually applied to the upright stem of ferns, the leaves of which are technically termed *fronds*, and the root-like or underground stem a *rhizome*.

Caulópteris (Gr. *kaulos*, stem, and *pteris*, fern).—Literally tree-fern; a genus of stems or trunks found in the Coal-measures, and by Lindley regarded as decidedly the stems of tree-ferns, in consequence of their shallow sinuous furrows, and spirally-arranged long oval leaf-scars.

Caves, Caverns (Lat. *cavus*, hollow).—Caves occur less or more along the rocky shores of all free-flowing seas, and are the results of abrasion by waves laden with gravel, &c., and acting upon pre-existing fissures or the softer portions of the exposed rocks. They occur chiefly in trap-rocks and in limestone strata—the former from structural and irregular wasting, the latter from infiltration and chemical erosion. The most celebrated

caverns, however, occur in limestone strata, and appear to be the results partly of fissuring by subterranean disturbance, and partly of waste by the percolation and passage of carbonated waters. They are sometimes arranged into four kinds—"1. Those which have arisen from fissures in the rock, and are therefore wedge-shaped crevices, widest at the opening. 2. Those that face the sea-shore, and are merely holes that have been worn out by the dashing of the waves against the cliff. 3. Those which open to the face of an inland cliff, and give egress to water. 4. Those whose entrances are holes in the ground opening very wide beneath, and having the appearance of water having at one time flowed in from above."—(J. E. Woods, 'Geol. Observ. So. Australia.') Some are celebrated for their great extent and subterranean waters (Kentucky); others for their gorgeous stalactites and stalagmites (Antiparos); and many, of late, for their treasures of sub-fossil bones (Kirkdale, Kent's-hole), and consequently known as "Bone Caves," or "Ossiferous Caverns," which see.

Cawk.—A familiar term for heavy-spar or native sulphate of barytes, which see.

Celestine (Lat. *caelum*, the sky).—A mineralogical term for sulphate of strontian, in allusion to its colour (sky-blue), which usually ranges from bluish-white to indigo blue, and is rarely reddish or yellow. Celestine occurs in rocks of all ages, but more frequently in the newer formations. Its average composition is 56.5 strontia, 42.5 sulphuric acid; with traces of iron, baryta, lime, and water.

Cément (Lat. *cementum*).—In building, literally chips for filling up the interstices between the larger blocks; now applied to mortar or any similar substance used for uniting other materials, and which ultimately hardens and binds them together. *Roman cement*, a mortar made of lime and pozzolano (volcanic tufa) ground to fine powder; *hydraulic cement*, any mortar that sets rapidly and hardens under water (which see). There are numerous builders' or architects' cements in the market, some for facing walls in imitation of stone, others for setting under water, some for resisting fire, and others for the exclusion of damp (as Gibb's, Parker's, Keene's, Pew's, Martin's, &c.); but in all of them *lime*, *silica*, and *alumina* in various proportions, and in different states of calcination, are the prime ingredients.

Centres of Creation.—"When the fauna or flora of a province (we quote the late Edward Forbes) has been thoroughly investigated, the diffusion of the individuals of the characteristic species is found to indicate that the manifestation of the creative energy has not been equal in all parts of the area; but that in some portion of it, and that usually more or less central, the genesis of new beings has been more intensely exerted than elsewhere. Hence, to represent a province diagrammatically, we might colour a nebulous space, in which the intensity of the hue would be exhibited towards the centre, and become fainter and fainter towards the circumference. This feature of zoological and botanical provinces gives rise to the term *centres of creation*; and in none, except one centre of creation, do we find the same assemblage of *typical* species; in other words, no species has been called forth originally in more areas than one."—See SPECIFIC CENTRES.

Cephalaspis (Gr. *kephale*, the head, and *aspis*, a shield).—A fish of the Lower Old Red or Devonian period, so called from having the bones of the head united into a single shield-like case, and terminating posteriorly

in three pointed spines or prongs—one on each side below, and a third in the mesial or dorsal ridge. The body also seems to have been protected by osseous bands and quadrangular scales, leaving the tail, pectorals, and other fins free as in the living trunk-fish. There are several species, all having the head large in proportion to the body, and none exceeding ten or twelve inches in length. The dentition, and even the position of the mouth, is unknown, though evidently placed beneath the head, and in all likelihood suctorial, as in the living sturgeon. The *Cephalaspidae* form a very limited family, and embrace such provisional genera as *Cephalaspis* proper, *Auchenaspis*, *Pteraspis*, and others of which very little is yet known.

Cephalópoda (Gr. *kephale*, the head, and *pous, podos*, foot).—The highest class of mollusca, so called from the principal organs of locomotion being attached to the head in the form of muscular arms or tentacles, as in the cuttle-fish and nautilus. In addition to their tentacular organs of motion, many have fin-like processes, and all can propel themselves by the forcible expulsion of water from their respiratory chamber. Of living forms one or two, like the nautilus, have *external* shells; all the others, like the cuttle-fish, are “naked” or shell-less, but possess an *internal* bone or “pen,” the representative of the shell. On the other hand, most of the fossil forms, as *orthoceratite*, *ammonite*, &c., have external shells, either straight, coiled in a vertical plane, or curved variously; though a large section also of the extinct forms were naked, and possessed internal “pens” or shelly organs which occur abundantly in Secondary strata, and are known as *belemnites*, *belemniteuthites*, and the like. Having numerous organs of prehension, powerful jaws like the mandibles of a parrot, spiny tongues, large eyes, acute senses, active locomotion, and a more concentrated nervous system than other mollusca, the cephalopods, both now and in former ages, appear to have been the tyrant scavengers of the waters. They are all marine and predatory, living on shellfish, crabs, and fishes. They occur fossil in all formations, and appear to have culminated in point of numbers and power during the Oolitic period—each great period having its own peculiar and characteristic forms. It is usual to divide the Cephalopods into two orders—the TETRABRANCHIATA and the DIBRANCHIATA, the former having four branchial plumes, two on each side, and the latter only two branchial plumes, one on each side. The tetrabranchs or Nautiloids form two families, the *Nautilidae*, and *Ammonitidae*—the former including the existing nautilus (the only living representative of the order), the orthoceratite, lituite, and others having external chambered shells with plain partitions, or sutural junctions and siphuncle more or less central; the latter the extinct ammonites, baculites, and others having also external chambered shells, but these with foliaceous complex sutures, and siphuncle dorsal, or on the back of the chambers. The dibranchs or cuttle-fishes, on the other hand, have almost always internal shells or “pens,” which are frequently rudimentary, and when external, or rather pseudo-external, are never chambered. They constitute two main sections—1st, Those with ten tentacular organs (decapoda), such as the *Spiralidae* or spirulæ, the *Sepiidae* or cuttle-fishes, the *Loligidae* or squids, and the fossil *Belemnitidae* or belemnites; and 2d, Those with eight tentacles (octopoda), such as the *Octopodidae* or poulpes, and the *Argonautidae* or paper-nautili, which are provided with a thin fragile pseudo-external shell. To the palæontologist many of these distinctions are of prime importance, and are curiously indicative of creational pro-

gress. Thus, in the Palæozoic genera the sutural junctions are plain and simple, while in the Mesozoic they become foliaceous and complex—*nautilites*, *goniatites*, *ceratites*, and *ammonites*, not only indicating generic distinctions, but time and successive formations. So also in Palæozoic genera their tentacles were void of acetabula or sucking-cups (TENTACULIFERA); while those of Neozoic periods are almost invariably provided with them (ACETABULIFERA). In like manner the *tetrabranchs* preceded the *dibranchs*, and thus, while the former is now represented by a single genus, the latter has representative families and genera in every region of the existing ocean.—See tabulations, "ANIMAL SCHEME."

Ceratiócaris (Gr. *keration*, a pod, and *káris*, shrimp).—An upper Silurian crustacean, whose exact affinities are unknown, but whose form apparently connects it with *apus* and *dithyrocaris*. It derives its name from its large, finely-striated, pod-like, bivalved carapace (which has frequently been mistaken for a bivalve shell); and its shrimp-like segmented body, which consists of five or six free segments, terminated by three strong sharp-pointed spines—the *leptocheles* of palæontologists before they were found in attachment. The finest specimens have been found in the upper Silurians of Lesmahagow.

Ceratites (Gr. *keras*, a horn—curved like a ram's horn).—A genus of Ammonitidæ, having the lobes of the sutures peculiarly crenulated. The ceratites are characteristic of the Trias (in which upwards of twenty species have been discovered), and are distinguished from the ammonites of the superincumbent Lias and Oolite by the absence of foliaceous sutures—the descending lobes terminating in small denticulations, as above described.

Cerátodus (Gr. *keras*, a horn, and *odous*, tooth).—A genus of cestraciont fish-teeth occurring abundantly in the "Bone-bed," between the Trias and Lias formations, and very puzzling from the variety of shapes they assume. They have in general an uneven or undulating upper surface of dentine and enamel, and an under layer of reticulated osseous tissue; the several plates or teeth apparently varying in form according to the position they occupied in the pavement-like palates of the cestraciont.

Ceratose (Gr. *keras*, a horn).—Horny; having the texture and consistence of horn. Applied to organic structures that have a horny aspect or consistence; e.g., the sponges, which are usually divided into the "ceratose," "siliceous," and "calcareous," or the *horny*, *flinty*, and *limy*.

Cerite, **Cererite**.—A siliceous protoxide of cerium, occurring in short six-sided prisms, also massive and granular; of a dark peach-red or clove-brown colour; very hard, and of dull adamantine or resinous lustre. Consists of 64.55 protoxide of cerium, 19.18 silica, 7.28 protoxides of lanthanum and didymium, 1.54 protoxide of iron, 1.35 lime, and 5.71 water.

Cerithian.—A term occasionally applied to certain strata of the Vienna Tertiary basin, from their being charged with several species of the spiral, elongated, gasteropod shell, *Cerithium*.

Cerithium (Gr. *keration*, a small horn).—A well-known gasteropod genus, the type of the *Cerithiada*. Shell turreted, elongated, many-whorled, with indistinct varices; aperture small, with a tortuous canal in front; outer lip expanded; inner lip thickened. The existing species (about 100) have a world-wide distribution; the fossil (about 400) range from the Trias upwards, some species being especially characteristic of Tertiary strata.

Cérium.—One of the rarer metals discovered by Hisinger and Berzelius in 1803, in the mineral named *cerite*, which consists of silica and protoxide of cerium with minor proportions of iron, lime, and water, together with the less-known metals *didymium* and *lanthanum*.

Cérussite (Fr. *ceruse*, white-lead).—Carbonate of lead occurring crystallised, fine, granular, or earthy; colourless or white, and often grey or yellowish-white, and consisting of 83.58 protoxide of lead and 16.42 carbonic acid. It is a common ore of lead, especially in beds or veins with galena (sulphuret of lead), from the decomposition of which it is supposed to be derived; the liberated sulphuric acid acting on calc-spar, whose carbonic acid combines with the protoxide of lead.

Cervical (Lat. *cervix*, the neck).—Belonging to the neck, as the *cervical* vertebrae, or vertebrae which form the neck.

Cestraciontids (Gr. *kestra*, a pike, a kind of fish, so called from its formidable teeth).—The first and oldest sub-family of sharks, beginning, says Buckland in his 'Bridgewater Treatise,' with the Transition strata, appearing in every subsequent formation till the commencement of the Tertiary, and having only one living representative—viz., the *Cestracion Philippi*, or Port-Jackson shark. The character of the cestracionts is marked by the presence of large polygonal obtuse enamelled teeth, covering the interior of the mouth with a kind of tessellated pavement. In some species not less than sixty of these teeth occupied each jaw. They are rarely found connected together in a fossil state, in consequence of the perishable nature of the cartilaginous bones to which they were attached; hence the spines and teeth usually afford the only evidence of the former existence of these extinct fossil species. They are dispersed abundantly throughout all strata, from the Carboniferous series to the most recent Chalk; e.g., *psammodus*, *cladodus*, *helodus*, *ceratodus*, *strophodus*, *acrodus*, &c.—See tabulations, "ANIMAL SCHEME."

Cetacea (Gr. *ketos*, a whale).—Cuvier's eighth order of mammalia, which includes the whales, dolphins, and other warm-blooded animals inhabiting the ocean. It is now usual to subdivide the order into sections—1st, the CETACEA, including the *Balenidae* or northern whales, the *Physiteridae* or sperm whales, and the *Delphinidae* or dolphins; and, 2d, the SIRENIA, or herbivorous cetaceans, which embraces the *Rhytinidae*, and the *Manatidae* or sea-cows. Remains of cetaceous animals occur only in recent and Tertiary strata; e.g., *Dinotherium* (?), *zeuglodon*, *balenoptera*, &c.

Cetiosaurus (Gr. *ketos*, whale, and *saurus*, lizard).—A genus of marine saurians, whose vertebrae and other bones occur in the Oolite and Wealden, and which has been so named by Professor Owen from the presumed general resemblance to the Cetaceans, in the short doubly-concave vertebrae, and the solid bones and natatory character of the extremities.

Cetotolithes (Gr. *ketos*, a whale, and *otos*, the ear, and *lithos*).—A term applied by Owen to the fossil petro-tympanics or ear-bones of whales, which occur abundantly in upper Tertiary formations, like the Suffolk and Norfolk "Crag." In general, the peculiar conchoidal-shaped tympanic bone is the only portion preserved.

Ceylanite.—Known also as *Candite*, from Candy in Ceylon; a dark-coloured variety of spinel, which see.

Chabasite or **Châbasite** (Gr. *chabos*, narrow, compressed).—One of the Zeolite family, occurring in compressed, striated, rhombohedral crystals, chiefly in the vesicular cavities and fissures of amygdaloid and other

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trap-rocks. Its colour is usually white, but sometimes passing into a greyish-yellow or pinkish tinge; its composition uncertain, analyses giving about 50 silica, 18 alumina, 9 lime, and 10 water, with traces of soda, potash, and iron.

Chalcédony.—More frequently *Calcedony*, which see.

Chalcolite (Gr. *chalcos*, bronze, and *lithos*).—A combination of uranium with phosphoric acid and copper, forming a cupreo-phosphate of uranium. It occurs in scales of an emerald or verdigris green colour, and is found in metalliferous veins traversing the granitic rocks and crystalline schists. Differs from URANITE (which see) only in containing copper instead of lime.

Chalcopyrite (Gr. *chalcos*, copper, and *pyrites*).—Copper pyrites; a common ore of copper, consisting of 34.78 copper, 30.47 iron, and 34.78 sulphur. Though a poor ore, nearly one-third of the copper of commerce is said to be obtained from this source. It may be distinguished from iron pyrites by its inferior hardness and deeper yellow colour, and from gold by its brittleness and want of malleability. The fine yellow varieties with a variegated (pavonine) tarnish are esteemed the richest.

Chalicotherium (Gr. *chalix*, *chalicos*, gravel).—A genus of fossil pachyderms (*Anisodon* of M. Lartet) intermediate between the rhinoceros and anoplothere, and characteristic of the upper Miocene strata of southern Europe and India. So named from its occurrence in the gravelly bed of the Eppelsheim strata.

Chalk (Lat. *calx*, Ger. *kalk*, lime).—The familiar as well as technical term for the soft and earthy-looking varieties of limestone. The Chalk of the south of England is well known, both as a rock and as the upper member of the *Cretaceous System*, which see. While the *white chalk* of commerce is well known as a soft amorphous carbonate of lime, which can be converted into *quicklime* by calcination, and used for all the purposes of ordinary limestone, it should be borne in mind that the term "chalk" has also been applied to other substances which are in no sense of the word limestones, as *Red Chalk*, a natural clay containing from 15 to 20 per cent of the protoxide and carbonate of iron; *Brown Chalk*, a familiar name for umber; *Black Chalk*, a variety of drawing-slate; and *French Chalk*, a variety of steatite or soapstone—a well-known soft *magnesian* mineral.—See CRETACEOUS SYSTEM.

Chalybeate (Gr. *chalybs*, iron or steel).—Applied to springs and waters impregnated with iron, or holding iron in solution. Springs, whose active principle is iron, are of two kinds—the *carbonated*, containing carbonate of the protoxide of iron; and the *sulphated*, containing the sulphate of iron.

Chalybite (Gr. *chalybs*, iron or steel).—Sparry or spathose iron, carbonate of iron, or siderite.—See IRON. The spathose iron-ores are said to afford the best kind of iron, and one which is admirably suited for the manufacturing of steel. "Nearly all the Styrian and Carinthian iron," says Mr Brislow, "is manufactured from chalybite. In those and the adjoining countries it forms extensive tracts, traversing gneiss, extending along the chain of the Alps on one side into Austria, and on the other into Salzburg. In Britain it occurs chiefly in Cornwall and N. W. of Devonshire and Somersetshire, where considerable quantities are raised on Exmoor and the Brandon Hills."

Chambered.—Usually applied to shells internally divided into chambers or compartments, like the existing nautilus.

Channel (Lat. *canalis*).—In geography, the course or excavation in which a river flows ; the deeper part of a strait, bay, or estuary where the principal current flows, whether of tidal or fresh water, and which is most convenient for navigation.

Cháos (Gr. *chaos*, literally an immense void or chasm).—Matter without form or arrangement ; according to the poets, the primal condition of the material universe before it was arranged and fashioned into *Cosmos*.
Chaotic.—Confused ; thrown together into a vast heap without any order or arrangement, like the debris resulting from a violent land-flood or debacle.

Charcoal.—The carbonaceous residue of animal, vegetable, and combustible mineral substances, when heated to redness in close vessels, or when they undergo smothered combustion. We have thus lamp-black or *animal charcoal*, derived from oils and fats ; *wood charcoal*, from twigs and faggots ; and *coke* or *mineral charcoal*, from ordinary pit-coal.—See CARBON.

Chart (Lat. *charta*).—A hydrographical or marine map, a draught or projection on paper of some part of the earth's superficies, with the coasts, islands, rocks, banks, channels, or entrances into harbours, rivers, and bays, the points of compass, soundings or depth of water, &c., to regulate the courses of ships in their voyages. While the term *map* is chiefly applied to delineations of terrestrial surfaces, *chart* on the other hand is applied to those of marine. There are various kinds of charts, *plane*, *globular*, &c., according to the mode in which the surface is projected or represented to the eye.

Chatoyant (Fr.)—Changing in lustre like the cat's eye ; a word expressive of that changeable lustre exhibited by various minerals, as they are turned less or more to the light ; e.g., cat's-eye opal, Labrador felspar, &c.

Cheiracanthus (Gr. *cheir*, the hand, and *akantha*, a thorn).—Literally "thorny hand," in allusion to the ichthyodorus or spine that protects the pectoral fins of this fish. The *Cheiracanthus* belongs to the Acanthod family ; is found in Devonian strata ; was a small, slim fish, covered with minute, angular, brightly enamelled scales, each having a slight median ridge, and armed in all its fins with defensive spines.

Cheirolepis (Gr. *cheir*, the hand, and *lepis*, a scale).—Literally "scaly hand," in allusion to its scaly pectorals ; a genus of Devonian fishes belonging to the family Acanthodes, and characterised by the great development of their pectoral and ventral fins, and by the presence only of a small subdorsal. In *Cheirolepis* the scales are lozenge-shaped, and richly adorned with minute waving striae on their posterior margins.

Cheiroptera (Gr. *cheir*, the hand, and *pteron*, a wing).—Literally "hand-wings,"—the Bats ; a well-known order of mammalia, whose fore-feet or *hands* are so modified as to enable them to exercise the power of flight—a power which they alone of all the existing mammalia possess. They are found in all parts of the world, but most abundantly in tropical countries ; are crepuscular and nocturnal in their habits ; and live, some on insects, others on the blood of the larger mammalia, and others again on fruits. Remains of the order occur in Tertiary strata, and also in many of the ossiferous caverns, where they seem to have lodged after the manner of their existing congeners.

Cheirotherium (Gr. *cheir*, the hand, and *therion*, a beast).—A term applied by Dr Kaup to an unknown quadruped, the hand-like impressions of whose feet are common on the slabs of the Trias or Upper New Red Sandstone.

It is supposed by Professor Owen to be one and the same with the batrachian or frog-like LABYRINTHODON, which see.

Cheirurus (Gr. *cheir*, hand, and *oura*, a tail).—Literally “hand-tail;” a genus of Lower Silurian trilobites, so termed from their tail or terminal portion presenting four or five finger-like spines or processes.

Chela (Gr. *chele*, a claw).—Applied particularly to the bifid claws or pincers of the crustacea, the scorpion, &c. Fossil *chela* (*Leptocheles*) occur as early as the Upper Silurian epoch.

Chelichnis (Gr. *chelone*, a tortoise, and *ichnon*, footprint).—The supposed footprints of tortoises occurring on the slabs of the Permian Sandstones of Corncockle Muir, in Dumfriesshire, and so termed by Sir W. Jardine, who has figured them in his ‘Ichnology of Annandale.’

Chelonia (Gr. *chelone*, the tortoise).—In Cuvier’s arrangement, the first order of the Reptilia, including the tortoise, the turtle, &c., in which the skeleton of the trunk is external, shell-like, and immovable—the upper portion being termed the *carapace*, and the lower or abdominal plate the *plastron*. Chelonian foot-tracks are supposed to have been discovered as early as the Old Red Sandstone period; but their actual remains have as yet been found only in the Oolite, Chalk, and Tertiary formations. In the Tertiaries of the Siwalik hills Dr Falconer discovered the carapace of the gigantic *Testudo Atlas*, or *Colossochelys*, measuring about 20 feet in diameter.

Cheropotamus, **Cheropotamus** (Gr. *choiros*, a hog, and *potamos*, river).—Literally “river-hog;” a pachydermatous quadruped occurring in the Tertiaries of France and England; very closely related to the Hog family, and forming, as it were, a link between the extinct anoplothere and the existing peccary. From its geological position, Professor Owen regards it as the earliest representative of the hog tribe on our globe; and from its dentition, considers it to have been more predacious or carnivorous than any of the existing species.

Chert (quasi *quartz*).—A mixed siliceous or impure flinty rock, or rather flinty portions occurring in other strata, as in limestone, &c. Resembles some varieties of flint and hornstone, but less conchoidal in the fracture, tougher, and fusible, which latter property is owing to an admixture, less or more, of calcareous matter. A limestone so siliceous as to be worthless for the limekiln, is said to be “cherty.”

Chesil Bank (Ger. *kiesel*, a pebble).—Literally “Pebble bank;” the well-known shifting pebble beach that extends from Portland to Abbotsbury, on the southern coast of England.

Chessylite.—The name given by Brooke and Miller to a fine crystalline variety of the blue carbonate of copper, from its occurring at Chessy, near Lyons. Known also as *Chessy Copper*. The primary form of Chessylite is an oblique rhombic prism; its colour from azure to Berlin-blue, and in earthy varieties, smalt-blue. “It is probably the result,” says Bristow, “of the decomposition of other ores of copper. It generally occurs lining cavities in primary and secondary rocks, and associated with malachite and red-copper. It forms a valuable ore of copper when abundant. It is also used when pulverised as a pigment, under the name of *Mineral-blue* or *Mountain-blue*; but it is not of much value, from its liability to turn green.”

Chiastolite (Gr. *chiastos*, marked with the letter χ , or cleft, and *lithos*, stone).—A crystalline mineral, by some regarded as a variety of *Anda-*

lusite, and by others as a distinct species. It occurs in long four-sided prisms of a pale-grey or greyish-green colour, with a dull vitreous lustre, which present a black or bluish-black crop in their transverse section. It is found imbedded in clay-slate, especially near granitic outbursts.

China-Clay.—A general term for the finer varieties of pottery clay, technically known as *Kaolin*, which see.

China-Stone.—A familiar term for the decomposed granites which yield the China-clay or Kaolin of commerce.

Chiton (Gr. *chiton*, a coat of mail).—A well-known gasteropod mollusc (the type of the family *Chitonidae*), whose elongated flexible covering or shell consists of eight transverse imbricating plates, lodged in a coriaceous mantle, which forms an expanded margin round the body; e.g., the *C. octovalvis* of our own shores. Chitons occur fossil from the Silurian upwards. Their detached plates are apt to be mistaken for the patelliform shells of other genera; but may be distinguished, in good specimens, by their granulated or sculptured surfaces, which are divisible into dorsal and lateral areas, by their processes of attachment on their anterior margins, as well as by their inner surfaces when these can be freed from the matrix.

Chitonellus (diminutive of *chiton*).—A sub-generic form of chiton, chiefly distinguished, at least in the fossil species, by the form of the plates, which were isolated or placed independently on the mantle, to which they were fixed by much larger processes of attachment than in *chiton* proper. Chitonelli occur fossil in several specific forms, the Permian limestones of Durham having as yet yielded the finest specimens.

Chlorite (Gr. *chloros*, green).—A soft friable mineral, closely allied in character to talc and mica, and so called from its greenish colour. It is generally massive and scaly, or imbedded and interspersed through other rocks. "Chlorite," says Nicol ('Man. of Mineral.'), "is one of the most widely dispersed and geologically important minerals. Externally it resembles mica [is flexible but not elastic like mica], and is frequently associated with, or replaces, it in granite, gneiss, and similar rocks. It is a component of the diabase porphyries and amygdaloids, and then often crystallised; and it is occasionally found in diorite, euphotide, and serpentine; more rarely in greenstone-porphry, amygdaloid, basalt, and trachyte. It is most abundant in chlorite slate, or in beds of potstone, intimately mixed with talc, for which it shows a strong affinity. From these it has passed into various sedimentary rocks, which owe to it their green colour. The Alps, Scandinavia, the Ural, the Harz, and many parts of Scotland, are well-known localities of chlorite, both in its crystallised variety and as a constituent of rocks." According to Kobell, a German variety consisted of silica 27.32, alumina 20.69, magnesia 24.89, iron protoxide 15.23, manganese protoxide 0.47, water 12.00. The most abundant varieties are common chlorite, chlorite slate (which contains upwards of 40 per cent of magnesia), and foliated chlorite.

Chloritic Sand (Gr. *chloros*, green).—Any sand coloured green by an admixture of the simple mineral *chlorite*, which see. The term is generally applied to the "Greensand" of the Chalk formation, which owes its prevailing colour to a chloritous silicate of iron.

Chlorophæsite (Gr. *chloros*, green, and *phaios*, brown, in allusion to the change of colour produced by exposure).—A soft sectile earthy mineral, occurring massive, or disseminated in amygdaloidal trap-rocks; translucent and olive-green when first exposed, but soon changes to blackish-

brown, and becomes opaque. Consists of 32.85 silica, 22.08 iron peroxide, 3.44 magnesia, and 41.63 water.

Chlorophane (Gr. *chloros*, green, and *phaino*, I shine).—A variety of fluor-spar, so called from its exhibiting a bright-green phosphorescent light when heated.

Choanites (Gr. *choane*, a funnel).—A genus of spongiform zoophytes occurring in the Chalk formation, and usually converted into flint. They are of a sub-ovate form, and appear to have been composed (according to Dr Mantell, who first described them) of a softer tissue than the ordinary sponges. They have a central funnel-like cavity (whence the name), were fixed at the base by long rootlets, and had their mass traversed by numerous channels which opened on the inner surface of the cavity, and which, in transverse sections, gives them the radiating appearance of a sea-anemone; hence the familiar term of "petrified anemones." The choanite is the commonest sponge in the Brighton brooch-pebbles.

Choke-Damp.—A miner's term for carbonic acid gas, as distinct from "fire-damp" or light carburetted hydrogen.—See **AFTER-DAMP**.

Chondrites (Lat. *chondrus*, a species of sea-weed).—Fossil marine plants of the Chalk and other formations; so called from their resemblance to the existing *Chondrus crispus*, or Irish moss of our own shores. The frond is thick, branched, dichotomous, or forking into cylindrical or claviform divisions, with a smooth surface, and without tubercles.

Chondrodite (Gr. *chondros*, a grain).—The hemi-prismatic chrysolite of Hally. One of the gems occurring in grains in crystalline limestone, &c., of various shades of yellow and red; transparent; and consisting of silicate of magnesia, with iron, potash, and fluorine.

Chondropterygii or **Cartilagines** (Gr. *chondros*, cartilage).—One of the great Cuvierian sections of fishes. The *chondropterygians* are distinguished from the *teleosteans*, or fishes with true bones, by their cartilaginous skeletons, and include sharks, sturgeons, rays, and lampreys.

Chondrosteus (Gr.).—Literally "cartilage-bone;" a provisional genus of fishes from the Liassic formation, having affinities to the sturgeons in the osseous scutes by which their bodies were protected.

Chrome, Chromium (Gr. *chroma*, colour).—One of the metals discovered by Vauquelin in 1797, and so named from its property of imparting colour to other bodies in a remarkable degree. Combined with oxygen it forms *chromic acid*, and this again, with other substances, forms *chromates*, as chromate of lead, chromate of iron, &c. In nature, chromium forms the colouring matter of various gems, as the emerald, ruby, &c.; and in the arts its preparations are extensively used as pigments.

Chrome Ochre.—Oxide of chrome, occurring in loose earthy masses, disseminated or investing, of a fine yellowish-green, but generally so mixed up with the rock in which it occurs as to be separable only by chemical means, and hence termed *chrome-stone*.

Chromite or **Chromate of Iron**.—A mineral consisting essentially of protoxide of iron and oxide of chromium, and occurring generally in serpentine or serpentinous limestones, either in veins, in nests, or disseminated. It is occasionally crystallised in octahedrons, but more frequently massive and disseminated in grains; of an iron-black or brownish-black colour, with a shining sub-metallic lustre. It is used in the preparation of various pigments, as chrome-green, chrome-yellow, &c.

Chrysoberyl (Gr. *chryso*, gold, and *beryllion*, a gem).—A species of cor-

undum, of a yellowish or asparagus green, and consisting chiefly of alumina, with glucina and protoxide of iron. When large and transparent it is used as a gem; the opalescent varieties, named *cymophane* (floating light), being most esteemed.

Chrysocolla (Gr. *chrysos*, golden, and *colla*, glue).—A silicate of the protoxide of copper, occurring in botryoidal or reniform crusts, of a fine emerald green, and apparently a product from the decomposition of copper ores, which it usually accompanies. Derives its name from the weak resinous lustre and peculiar transparency of its fractured edges.

Chrysolite (Gr. *chrysos*, gold, and *lithos*).—A green-coloured mineral occurring in trap and volcanic rocks, and consisting of about 40 silica, 50 magnesia, and 9 protoxide of iron, with traces of alumina, manganese, and nickel. The fine green-coloured transparent crystals are known as *chrysolite*; the less pellucid granular masses as *olivine*; and less-known and duller-coloured varieties as *chusite*, *fazalite*, *hyalosiderite*, &c.

Chrysoprase (Gr. *chrysos*, gold, and *prasinos*, leek-green).—A fine apple-green to leek-green variety of calcedony, which owes its colour, according to Klaproth, to a small percentage of oxide of nickel.

Cidaris, Cidarites (Gr. *kidaris*, a turban).—A genus of the family *Echinidea* or sea-urchins, characterised by their hemispherical, globular, or sub-oval shape; parallel ambulacra, that is, diverging equally on all sides from the vent to the mouth; vent vertical; mouth beneath and central. Living, and fossil from the Carboniferous Limestone upwards. Many of the *cidarites* are of large size, and are furnished with long and often curiously ornamented spines.

Cilia (Lat. *cilium*, an eyelash).—Applied in zoology to a peculiar sort of moving organs, resembling microscopic hairs; e.g., the hair-like filaments that surround the mouths of polypes. *Ciliated*, furnished or fringed with cilia; *ciliary motion*, that rapid vibratile motion characteristic of cilia in a state of action.

Cimoliornis (Gr. *kimolia*, a kind of fuller's clay, and *ornis*, bird).—Literally *Chalk-marl Bird*; a generic term applied by Professor Owen to certain bones from the Lower Chalk-marls, and considered to be those of birds. It is doubtful, however, whether they do not belong to the *Pterodactylus compressirostris*, and until more is known of the osteology of the Pterodactyles, the name must be received merely as provisional.

Cimolite.—Cimolian earth; a pure white or greyish-white variety of clay, or hydrous silicate of alumina, so called from its occurring in the island of Cimola (now Argentina) in the Grecian Archipelago. It is used as a fuller's earth; and, like kaolin, results from the decomposition of felspar in trachyte or other felspathic rock.

Cinder-Bed.—A stratum of the Upper Purbeck series, almost wholly composed of oyster-shells; and so named by the quarrymen from its loose incoherent composition.

Cinnabar (Gr. *kinndbari*).—Sulphuret of mercury, occurring in crystals, disseminated and granular, compact, or earthy, and usually of a fine cochineal-red or vermilion colour. It is found in the crystalline, transition, and secondary strata, in beds or veins, and associated with native mercury, iron-pyrites, and other ores. It is the principal ore of mercury, which is obtained from it by sublimation or distillation. The purer varieties are used as a pigment; but the vermilion of commerce, which is an artificial cinnabar, is prepared from the crude ore.

Cinnamon-Stone.—A variety of garnet, belonging to what is termed the "Lime-alumina" division of the family, and so called from its cinnamon or orange-yellow colour.—See GARNET.

Cipolin or **Cipollino.**—An Italian term for a whitish marble, variegated with zones or shadings of green talc or chlorite; and so called from its resemblance to the alternating green and white coats of an onion (*cipollina*, a shallot or onion).

Cirripedes, **Cirrhépédia**, **Cirrhópoda** (Gr. *kirros*, a curl, and *pous*, *podos*, a foot).—A class of articulated animals, including the barnacles and acorn-shells, which obtain their name (curl-footed) from the many-jointed curled tentacles which terminate their feet. In their adult stage they are furnished with a shelly covering consisting of several pieces, some being sessile, others attached by a long fleshy peduncle. They are found fossil from the Oolite upwards—*pollicipes*, *balanus*, *scalpellum*, &c.

Clathrária (Lat. *clathrum*, a lattice).—A genus of fossil stems, first discovered by Dr Mantell in the Wealden of Sussex, and so named from the lattice-like arrangement of the lozenge-shaped leaf-scars which ornament their surface. They are evidently gymnogens, and appear to have the nearest relation to the *Cycas* family, though certain fruits generally found along with them seem to point to the true *Coniferae*.

Clathrópteris (Lat. *clathrum*, a lattice, and *pteris*, fern).—Literally "Lattice-fern;" a genus of gigantic ferns apparently peculiar to the Wealden. The leaf is deeply pinnatifid; leaflets elongated and traversed by a strong midrib; secondary veins perpendicular to the midrib, and united by transverse branches, which produce a network of quadrangular meshes; hence the name.

Clavate (Lat. *clava*, a club).—Club-shaped; slender at one extremity, and gradually thickening and terminating obtusely at the other.

Clay Ironstone.—A familiar term for the impure earthy carbonates of iron which occur in nodules, layers, and bands, chiefly in the Coal-formation; hence *clay-band* in contradistinction to *black-band*.—See IRONSTONE.

Claystone.—An earthy felspathic rock of the Trap group, occurring in veins as well as in mountain masses, and differing from compact felspar in being softer, and having the aspect and texture of a baked or indurated clay. It becomes porphyritic by the intermixture of felspar crystals, and is then known as *claystone porphyry*. The prevailing colours are buff and reddish-browns, with various tints approaching to purple.

Cleavage.—That peculiar structure in many fine-grained stratified rocks, such as clay-slate, which renders them capable of being split indefinitely into thin plates or laminae, and this in a direction independent of their bedding or stratification. Occasionally the lines of cleavage may coincide with those of bedding when the strata stand at high angles, but for the most part it is transverse, and even often at right angles to the original sedimentary layers. As a superinduced structure occurring among the semi-crystalline or metamorphic strata, its origin has given rise to many hypotheses—the chief of which may be regarded as *mechanical* or *chemical*, according as they are founded on physical or on chemical considerations. Thus, those who regard cleavage as a minute species of jointing, generally running parallel to great axes of elevation, and altogether independent of the strike or dip of the strata through which it passes, adopt the mechanical theory of great lines of cosmical uprise and contraction, which produced immense pressure on the irregular particles or interstitial cavities

of the cleaved masses; while those who regard it as a species of crystallisation or new molecular arrangement adopt a chemical view, and ascribe the appearances to the long-continued but as yet imperfectly understood operation of electrical or chemical forces. Professor Sedgwick, for instance, who has directed much of his attention to metamorphic phenomena, propounds a chemico-electrical hypothesis (founded on the artificial production of cleavage by passing magnetic currents through masses of moistened clay), by which "crystalline or polar forces have rearranged whole mountain-masses, producing a beautiful crystalline cleavage, passing alike through all the strata;" while Professor Phillips appeals in the main to "mechanical forces compressing the sediment at right angles to the lines of cleavage." On the other hand, Mr Daniel Sharpe attempts to combine with this mechanical theory "the action of some peculiar crystalline force;" while Messrs Sorby and Tyndall adopt the purely mechanical view—the former maintaining that the flattish unequiaxed particles of the ancient mud and sand greatly aided the compressing force in producing cleavage; and the latter, that the result was unaided by the shape of the particles, but was caused by the extension under pressure of the minute interstices which must exist in even the most finely levigated mudstones.

—See METAMORPHISM.

Cleavelandite (after Professor Cleaveland).—One of the Felspar family, and known also as *albite*, but differs little either in form or composition from ordinary felspar or *orthoclase*.

Cleithrolepis (Gr. *kleithron*, a lock, and *lepis*, scale).—A genus of Pycnodont fishes from the Carboniferous rocks of Sydney, New South Wales; and so called by Sir P. Egerton, from the mode in which the transversely oblong scales are locked by articulating processes into each other. In general aspect *Cleithrolepis* greatly resembles *Platysomus*, but differs in the dorsal and anal fins being placed farther back, and in their rays increasing in length backward, instead of diminishing; and also in the tail being less decidedly heterocercal. In *Cleithrolepis* the cranial bones and scales are also ornamented with fine granulations.—('Geol. Journal' for 1863.)

Cleveland Ironstone.—An important ore of iron obtained from the Cleveland district in Yorkshire, where a stratum, 16 feet thick, of a rusty-looking sandstone (the "Lias Band") crops out from the middle of the Lias formation, and is considered to yield on an average about 30 per cent of iron. "It is chiefly," says Ansted, "a carbonate of the protoxide of iron, with about 30 per cent of impurity, consisting of silica, alumina, lime, and magnesia, and a little water. It is sometimes massive, and sometimes alternates with shaly bands, and is generally oolitic in structure. It extends over a district of some hundreds of square miles, thinning out to the south, and capped by sandy shales containing scattered nodules of ironstone. Upwards of a million of tons of ironstone are annually extracted from this deposit, chiefly near Middlesborough."

Climate (Gr. *klima*, an inclination).—Originally applied in a technical or astronomical sense to the various belts of the earth as influenced by the length of the day—each zone from the equator to the polar circles being measured by half-an-hour's increase on the longest day, and from the polar circles to the poles by the increase of a month. The length of the day at the equator being twelve hours, the first climatic belt extended to the latitude where the longest day was twelve and a half hours long, and so on for every half-hour's increase, there being *twenty-four* such climes

between the equator and the polar circles, and *six* between the polar circles and the poles. The term is now applied to the general *weather-conditions* of any district, as these may be mild or rigorous, genial or ungenial, salubrious or obnoxious, &c. In a wider sense, when treating of countries geographers speak of *insular* and *continental* climates: the former, from their proximity to the sea, being comparatively mild in winter, and cool in summer; and the latter, cold in winter, but excessively hot in summer. **Climatology**.—The science which treats of the different climates of the earth, their causes, products, and peculiarities.

Clinker.—In mineralogy, the black oxide of iron, readily obtained in scales and globules from red-hot iron while under the hammer of the blacksmith. In familiar language the term is applied to the slaggy ferruginous crusts that form on the bars of engine-furnaces, round the taps of iron-furnaces, and the like.

Clinkstone.—A flinty felspathic rock or hornstone, of a greyish-blue colour, having a tendency to divide into slabs, and ringing or “clinking” with a sort of metallic sound when struck by the hammer. Many so-called *clinkstones* are merely basaltic greenstones, having a shivery or fissile structure—the thin slabs ringing under the hammer. When the rock contains disseminated feldspar, it is called *Clinkstone Porphyry*.—Same as PHONOLITE, which see.

Clinoclase (Gr. *klino*, to incline, and *klao*, to break).—Arsenate of copper, so called in allusion to its oblique cleavage. Occurs in the copper mines of Cornwall and other localities in small oblique rhombic prisms of a dark verdigris-green inclining to blue.

Clinometer (Gr. *klino*, to lean, and *metron*, a measure).—An instrument, of which there are several sorts, for measuring the dip or angle at which strata incline from the horizon. One of the most commodious and portable is that formed by attaching a pendule to the pivot of the common field-compass—the frame of which being laid to the surface of the stratum the pendule indicates the angle of inclination.

Clinonites.—A genus of minute fossil sponges, or rather the silicified casts of these sponges, occurring in perforations of shells found in the Chalk formation. They are named after the existing parasitical sponge *cliona*, whose perforations often completely riddle the oyster and other shells.

Clunch.—An English provincial term for any tough coarse clay; applied to certain clays of the Coal-measures, and also to the hard clayey beds of the Gault or Chalk-marl.

Clyménia (Gr. *clymene*, a sea-nymph).—A genus of nautiloid shells peculiar to Devonian strata, in which upwards of forty species have been detected. In the clymenia, the septa of the chambers are simple or slightly lobed, and the siphuncle is internal, or on the inner side of the whorls; hence the occasional synonyme, *Endosiphonites*.

Clypeastridae (Lat. *clypeus*, a buckler).—A family of fossil sea-urochins occurring in the Chalk, and characterised by their oblong or rounded form; mouth somewhat angular, and furnished with well-developed teeth; outlet distant from the summit; tubercles mere granulations, and the spines proportionably small. The group is usually divided into the *Galeritidae* (helmet-like) and the *Clypeidae* (buckler-like).

Coal (Gr. *kohle*; Fr. *houille*).—In mineralogical systems the COALS constitute a limited, but very distinct and highly important family, which embraces such species as *graphite*, *anthracite*, *common coal*, *brown-coal* or

COAL

lignite, and *peat*. Chemically, their chief constituent is carbon, in combination with varying proportions of hydrogen, oxygen, and nitrogen; and in all there exists a greater or less amount of earthy impurities, which being incombustible, remain, after burning, as ashes. From their composition, which only differs from vegetable or woody matter in the diminished amount of its gaseous and volatile elements—from their internal structure, which, for the most part, exhibits to the naked eye, and almost always to the microscope, abundance of vegetable tissue—and from their lithological and other characteristics—there can be no doubt of their vegetable origin; whether occurring as peat and lignite, in which the ligneous structure is still apparent, or as common coal and anthracite, in which, for the most part, mineralisation is so perfect as to have obliterated every external trace of their organic origin. We have thus the most satisfactory evidence that COAL, in all its species, is merely mineralised vegetation—vegetation which, in part, grew and was submerged *in situ* as peat-mosses, cypress-swamps, jungles, and forest-growths, and in part was *drifted* by rivers into the seas of deposit, whose varied strata of sandstones, limestones, shales, mudstones, coals, and ironstone, now constitute our available Coal-Fields. Of course, as the operations of nature are uniform and incessant, we have Coals of all periods—graphites and anthracites of the Silurian and Devonian, bituminous coals of the Carboniferous and Jurassic, lignites of the Tertiary, and peats of the current epoch—the products differing in quality according to the amount of mineralisation and subsequent metamorphism to which they may have been subjected. The available coal of Great Britain is no doubt of *Carboniferous* age, but many excellent coal-fields in India, America, and other countries, belong to the Jurassic and Chalk periods, while anthracites and graphites may belong to any epoch, just as the original bituminous coal may have been subjected to heat and other metamorphic processes. Like all mixed rocks, common coal presents many varieties—and these, according to their structure, texture, and qualities, have received various names, as *caking coal*, which is soft or “tender” in the mass, like that of Newcastle, and swells and cakes together in burning; *splint* or *slate coal*, which burns free and open, and is hard and slaty in texture; *cannel*, which is compact and jet-like in texture, and burns with a clear candle-like flame, and, from its composition, is chiefly used in gas manufacture; and *coarse, foliated, or cubic coal*, which is more or less soft, breaks up into large fragments, and contains in general a large percentage of earthy impurities. Between these there is, of course, every gradation—coals so pure as to leave only one or two per cent of ash, others so mixed as to yield from ten to thirty per cent, and many so impure as to be unfit for fuel, and so to pass into *shales* more or less bituminous. The following analysis exhibits proximately these gradations, but mainly that varying proportion of gaseous elements which marks the passage of wood into peat, peat into coal, and coal into anthracite and graphite:—

(At 212°.)	Carbon.	Hydrogen.	Oxygen.	Nitrogen.	Inorganic Ash.
Wood.....	48—54	6—10	35—45	...	...
Peat	56—66	5—9	18—33	2—4	1—6
Lignite	56—70	3—7	13—27	1—0	1—13
Coal	70—92	2—6	1—8	0—2	3—14
Anthracite	74—94	1—4	0—3	trace	1—7
Graphite	80—98	...	...	...	1—7

According to M. Fremy, the following are the degrees of alteration of woody tissue: 1. *Turf and Peat*.—Characterised by the presence of ulmic acid, and also by the woody fibres or the cellules of the medullary rays, which may be purified or extracted in notable quantities by means of nitric acid or hypochlorites, in which they are insoluble. 2. *Fossil Wood or Woody Lignite*.—This, like the preceding, is partially soluble in alkalies, but its alteration is more advanced, for it is nearly wholly dissolved by nitric acid and hypochlorites. 3. *Compact or Perfect Lignite*.—This substance is characterised by its complete solubility in hydrochlorites and in nitric acid. Alkaline solutions do not in general act on perfect lignites. Reagents in this variety show a passage of the organic matter into coal. 4. *Coal*.—Insoluble in alkaline solutions and hydrochlorites. 5. *Anthracite*.—An approximation to Graphite; resists the reagents which act on the above-mentioned combustibles, and is only acted on by nitric acid with extreme slowness.

Cobalt (Ger. *Kobold*, the demon of German mines).—A metal discovered by Brandt in 1733. As an ore it is found chiefly in combination with arsenic as *arsenical cobalt* or *smaltine*, or with sulphur and arsenic as *grey cobalt ore*. As a metal it is white and brittle, unchanged in the air, has a high melting-point, is strongly magnetic, and has a specific gravity of 8.5. It is seldom used in the metallic state, owing to the difficulty of reducing its ores, but these are extensively employed in the arts, as in the production of pigments, inks, stains, and glazes. The ores of cobalt (smaltine, sulphuret of cobalt, &c.) occur in granitic, crystalline, and secondary formations, in connection with ores of silver, copper, &c.; and being at first mysterious and intractable, received their name from the mysterious *Kobold*, who is supposed to obstruct the operations of the miners. "The quite recent discovery (says Sir J. Herschel in his 'Physical Geography,' 1861) of the exceeding tenacity of metallic cobalt, *which is double that of iron*, promises to place this metal in the first rank of mechanical utility."

Cobaltine.—Arsenical ore of cobalt, occurring in cubical crystals, and also in arborescent, stalactitic, and amorphous masses. Consists of 13.95 cobalt, 11.71 iron, 70.31 arsenic, with traces of nickel, copper, &c. This ore of cobalt and smaltine furnish the greater portion of the *smalt* of commerce. It is prepared by roasting the ore, and then melting the oxide of cobalt so produced in certain proportions with pure potash and pounded quartz, which is afterwards ground to powder and carefully washed.

Cóccolite (Gr. *kokkos*, a berry, and *lithos*).—Granular sahite; a variety or sub-species of augite occurring in the iron-mines of Norway and Sweden in granular or berry-like concretions; hence the name.

Cóccosteus (Gr. *kokkos*, a berry, and *osteon*, a bone).—Literally "berry-bone;" a fish of the Old Red Sandstone, and so termed from the small berry-like tubercles with which the plates of its cranial buckler and body are thickly studded. In general appearance *Cóccosteus* resembles *Pterichthys*, but wants the arm-like appendages, and is usually much larger—ranging in the Caithness flagstones from a few inches to two feet in length. In both, the body-plates were similarly arranged and tuberculated; in both, the tail or terminal portion was covered with scales, and supported a fin or fins; and both seem to have possessed small bony teeth in either jaw. Hugh Miller and Dr Pander have attempted outlines, but the data are yet insufficient for a satisfactory restoration. It is usual to arrange *Cóccosteus* and *Pterichthys* under the family *Cephalaspidæ*; but the group is yet too

little understood for this arrangement, and in the mean time all that can safely be done is to rank them as members of the great order of **PLACODERMS** or **PLACOGANOIDS**, in allusion to the bony plates which constitute their external covering or skeleton.

Cóchliodus (Gr. *kochlias*, a cockle, and *odous*, tooth).—Literally "cockle-like tooth;" a genus of Cestraciant fish-teeth occurring in the mountain limestone, and so termed from their cockle-shell-like aspect.

Celacánthi (Gr. *koilos*, hollow, and *acantha*, spine).—Literally "hollow-spines;" an extensive group of fossil sauroid fishes, that derive their name from the central cavity in their fin-rays, which, however, may have had originally cartilaginous cores. They occur from the Devonian to the Chalk inclusive, and embrace such genera as *celacanthus*, *asterolepis*, *dendrodus*, *holoptychius*, *rhizodus*, *macropoma*, &c.

Ce'lodont (Gr. *koilos*, hollow, and *odous*, tooth).—Literally "hollow-toothed;" a term applied to those lacertilians or lizard-like reptiles which have hollow teeth, in contradistinction to the *Pleodont* or solid-toothed.

Ce'loptychium (Gr. *koilos*, hollow, and *ptyche*, a fold or wrinkle).—A genus of sponges occurring in the Cretaceous and Lower Tertiary beds near Brunswick in Germany. They are mushroom-shaped organisms mounted on a short tapering stalk—the main body or hood being hollow, and more or less lobed and wrinkled at the margin, whence the name "hollow-wrinkle."

Ce'lorhynchus (Gr. *koilos*, hollow, and *rhynchos*, beak).—Literally "hollow-beak;" a genus of sword-fishes whose prolonged premaxillary bones or "swords" have been found in the Upper Chalk and Eocene Tertiaries of England.

Ce'noc'cium (Gr. *koinos*, common, and *oikos*, dwelling).—The term employed by Professor Allman to designate the plant-like structure or common dermal system of the polyzoa, in contradistinction to the *polypary* or *polypidom* of the true polypes.

Coke.—Charcoal; the carbonaceous residue of coal after the volatile matters have been driven off by heat. Formerly coke was prepared by a smothered combustion of the coal in open-air heaps; now it is prepared in ovens specially constructed for the purpose.

Coleóptera (Gr. *koleos*, a sheath or case, and *pteron*, wing).—Sheath-winged; an order of insects, like the beetles, furnished with hard crustaceous sheaths (*elytra*) which cover and protect their membranous wings or organs of flight. Coleopterous insects are found fossil from the Coal formation upwards.

Collywéston Slates.—Also known as "Collyweston Tilestones;" a subordinate series of laminated calcareous beds occurring at Collyweston, near Stamford, in Lincolnshire; and from their position supposed to be the equivalents of the celebrated "Stonesfield Slate."

Cologne Earth.—An earthy, peaty mass of lignite, or partially fossilised wood, of a deep brown colour, occurring in an irregular bed of from 30 to 50 feet thick, near Cologne, Lower Rhine.

Cololites (Gr. *kolon* and *lithos*).—A name given to certain tortuous and convoluted intestinal-like masses and impressions which appear in some instances to be either the petrified intestines of fishes, or the contents of their intestines, still retaining the forms of the tortuous tube in which they were lodged,—hence the name; but which in the majority of cases are undoubted worm-casts, like those of the lob-worm.

Colóssochélys (Gr. *kolossoe*, a statue of enormous size, and *chelys*, a tor-

toise).—The generic term given by Dr Falconer to the bones and portions of the carapace of a tortoise of gigantic dimensions, discovered by him and Captain Cautley in the Upper Tertiaries of the Siwalik Hills in India. The remains discovered indicate a length of twelve or fourteen feet.

Colour of Minerals.—In describing rocks and minerals, their colours are usually mentioned as a simple and obvious aid to identification. Mineralogists divide these into the *metallic* and *non-metallic*,—the latter embracing the ordinary colours, as *black, white, red, green, &c.*; or combinations of them, as *yellowish-white, reddish-brown, blackish-green*, and the like; or peculiar hues taken from familiar objects, as *chestnut-brown, olive-green, sky-blue*, and so forth. The metallic colours, on the other hand, are less numerous, and much more decided and peculiar; hence we have *copper-red*, the colour of native copper; *bronze-yellow*, as iron-pyrites; *brass-yellow*, copper-pyrites; *gold-yellow*; *silver-white*; *tin-white*; *lead-grey*, as galena; *steel-grey*; *iron-black*, as specular iron-ore; and a few other shades equally distinct and decided.

Columbian (*Columbia*, America).—The metal now generally known as *Tantalite* (which see), but said to have been first discovered in ore found in Connecticut, North America.

Columnar (Lat. *columna*, a column).—Having the form of columns; arranged in columns. The basalts of Staffa and the Giant's Causeway are said to be *columnar*, because composed of column-like masses less or more regular in form and arrangement. When the form and arrangement of these masses are indistinct and irregular, the structure is said to be *sub-columnar*.

Combe or Coomb (Sax.).—A common term in the south of England for an upland valley, generally narrow, and without a stream of water. Dr Buckland remarks, "The term *combe* is usually applied to that unwatered portion of a valley which forms its continuation beyond and above the most elevated spring that issues into it; at this point or spring-head the *valley* ends and the *combe* begins."

Combination (Lat. *con*, together, and *bina*, two by two).—In chemical language, a combination is not a mere *mingling* of two substances producing a mixture intermediate between the two, but a *union* producing a *third substance* different from either.

Combustion (Lat. *con*, together, and *uro*, I burn).—Consumption by fire; the act of burning. In chemistry, this term is generally applied to the phenomena exhibited by burning bodies, and which depend upon the rapid union of the *combustible* with the oxygen of the air. The heat and light which accompany ordinary combustion, announce intense chemical action; and the consequence is that combustion is always attended by the production of new compounds. **Combustible**.—Susceptible of being burnt; having the property of catching fire. In mineralogy the combustible or inflammable minerals are—sulphur, diamond, the coals, bitumens, mineral resins, and the inflammable salts.

Commminute (Lat. *con*, and *minuo*, I lessen).—To reduce to small fragments. **Commintated**.—Reduced to small fragments, like the broken shells (shell-sand) of the sea-shore.

Comptonite.—Known also as *Thomsonite*, after the well-known chemist; one of the Zeolite family, occurring with calc-spar and other zeolitic minerals in cavities, in trap-rocks, and in old lavas. Named after Lord Compton, who brought it from Vesuvius in 1818.

Conchifera (Gr. *conche*, a shell, and *fero*, I bear).—An extensive class of acephalous bivalve mollusca, including the oysters, scallops, mussels, and cockles. The conchifera are mostly equivalve, and are usually divided into two orders—the *Monomyaria*, or those having only *one* muscular impression on the valve; and the *Dimyaria*, or those having *two* muscular impressions, and consequently furnished with two adductors.—See tabulations, “ANIMAL SCHEME.”

Conchitic (Gr. *conche*, a shell).—Composed of shells; containing shells in abundance. Applied to limestones and marbles in which the remains of shells are a noticeable feature. The simpler terms “shell-limestone” or “shell-marble” are now more frequently employed.

Conchoidal (Gr. *conche* and *eidos*, form).—Shell-like; applied to that peculiar *fracture* of rocks and minerals which exhibits concave and convex surfaces resembling shells; thus, when we chip a piece of flint or cannel-coal, the newly-exposed surface exhibits the *conchoidal fracture*.

Conchorhynchus (Gr. *conchos*, a shell, and *rhynchos*, a beak).—De Blainville’s generic term for the fossil calcareous mandibles of cephalopods, in contradistinction to *rhyncholites*, which is usually applied to the upper mandible.—See RHYNCHOLITES.

Cóncrete (Lat. *con*, together, and *cretus*, grown).—A compact mass, composed of coarse pebbles and sand, run or cemented together by lime. Concrete is employed in the foundations of buildings, as a groundwork for causewaying, and occasionally as an artificial stone or pavement. About 60 parts of pebbles, 25 of river-sand, and 15 of lime, form a good concrete.

Concrétion, Concretionary (Lat. *con* and *cretus*, grown together).—Nodules like those of chert and ironstone, the grains and spherules of oolite, and the grape-like clusters of the magnesian limestone, are termed “concretions,” as formed by a molecular aggregation distinct from *crystallisation*. The *concretionary structure* is very apparent in certain deposits from calcareous springs (*e.g.*, the pisolite of Carlsbad), in many greenstones, and in other rocks both of ancient and recent formation.

Confervites.—Fossil plants, apparently allied to the aquatic confervæ; occurring chiefly in the Chalk formation.

Cónfluence (Lat. *con*, and *fluo*, I flow).—The point at which two or more streams meet; the junction of a tributary stream with the main river.

Conformable.—Strata or groups of strata lying one above another in parallel order are said to be *conformable*; when not in the same plane, or not dipping at the same angle, with those on which they are deposited, they are termed *unconformable*, which see.

Congénères.—Applied in natural history to plants and animals that belong to the same genus.

Congérian.—A term occasionally applied to certain strata of the Vienna Tertiary basin, from there being charged with species of the mussel-like shell *Congerita*, known also as *Mytilomya* and *Dreissena*.

Conglómerate (Lat. *con*, together, and *glomerare*, to gather in round heaps).—Rocks composed of consolidated gravels, just as sandstones are composed of consolidated sands; known also as *puddingstones*, from the resemblance of the pebbles in the mass to the fruit in a plum-pudding. In *breccias* the fragments are more or less angular; in *conglomerates* they are rounded and water-worn, and may vary from pebbles the size of a pea to boulders half a ton in weight.—See PUDDINGSTONE.

Conifers, Coniferous.—Cone-bearing; applied to the pine tribe, whose

seeds occur in cones, as the larch, pine, &c. The order includes the firs, pines, yews, junipers, &c., some of which have berry-shaped rather than scaly-coned fruit; but in all the family resemblance, habit, and woody structure are greatly alike. Structurally considered, the *conifers* stand intermediate between the *endogens* and *exogens*, forming the *gymnogens* or *gymnosperms* of the botanist. Undoubted coniferous wood makes its first appearance in the Carboniferous system, and continues upwards throughout all the subsequent formations.—See tabulations, "VEGETABLE SCHEME."

Cónodonts.—Literally "cone-teeth;" minute, glistening, slender, conical bodies, hollow at the base, pointed at the end, more or less bent, with sharp opposite margins, and occurring in thousands in the Lower Silurian schists of Russia. They are supposed by Pander to be the horny teeth of cartilaginous fishes; but this view is opposed by Huxley, Owen, and other naturalists, who regard them as more likely to be the "spines or hooklets or denticles of naked molluscs and annelids"—an opinion which has many geological coincidences to support it.

Contemporaneous (Lat. *con*, together, and *tempus*, *temporis*, time).—Existing at the same period; formed during, or belonging to, the same geological epoch. **Contemporaneity.**—The state of being contemporaneous with; hence we speak of lines and strata of contemporaneity in widely separated portions of the same system.

Contorted (Lat. *con*, together, and *torsus*, twisted).—Applied to strata which, like gneiss and mica-schist, exhibit frequent irregular bendings and flexures, as if they had been crumpled and twisted while in a soft and yielding condition.

Contour (Fr. *contour*, from *con*, and *tour*, a turn).—In geography, the outline or horizontal configuration of any portion of the land, as defined by the waters of the ocean that surround it.

Conulária (Lat. *conulus*, a little cone).—A genus of Pteropod shells, so called from their tapering conical outline. Conularia is four-sided, straight, tapering, the angles grooved, and the sides striated transversely, as if the thin shell had been divided by numerous septa. Several species are found in the Silurian, Devonian, and Carboniferous formations.

Copaline.—A fossil resin, found in the London and other Tertiary clays. It occurs in irregular pieces of a pale yellowish or dusty brown colour, and is so named from its resemblance to copal-resin in colour, lustre, transparency, hardness, and difficulty of solution in alcohol. It is brittle, yields readily to the knife, and melts easily, giving off a resinous and aromatic odour.

Cophins (Gr. *kophinos*, a basket).—A term applied to curious organic markings, as yet detected only in Silurian shales, but common, in all probability, to all Palæozoic and Mesozoic mudstones. Their shape is inversely pyramidal, more or less circular and upright, and having the sides scored with elegant transverse grooves resembling fine wicker-work, whence the name. They are supposed to be impressions made by the stems of encrinetes, which, rooted and half-buried in the micaceous mud, have produced, by their wavy and somewhat rotatory motion, the beautiful pattern, every line of which answers to one of the projecting rings of the jointed stem. The funnel-shaped hollow produced in wet soil by the waving of a flower-stem in a windy day is an analogous phenomenon.

Copper (Lat. *cuprum*, a corruption of *Cyprium*, from the island of Cyprus, whence it was anciently brought).—One of the most abundant and earliest

known metals, being the chief ingredient in domestic utensils and implements of war before the use of iron. It occurs *native* in the metamorphic and igneous rocks in threads, strings, and arborescent incrustations; in plates and laminae; also investing, massive, and disseminated; but rarely in loose grains or lumps. Occasionally it is found deposited in mines from water containing the sulphate, after the manner of the electrotype process; and not unfrequently large anomalous masses, weighing from 1600 to 4000 lb. (like those of Lake Superior and South America), are found in the igneous rocks. More frequently and more abundantly it occurs as an *ore* in many formations—the yellow copper-ores (pyrites), the grey copper-ores, the red copper-ores, and some of the copper salts being the most important and valuable. As a metal it is distinguished by its peculiar red ("copper-red") colour; has a hardness of from 2.5 to 3; specific gravity, from 8.5 to 8.9; is malleable and ductile; and requires a temperature of nearly 2000° Fahr., or that of white heat, to fuse it. It is readily acted on by acids, which form with it blue or green salts; and as these are poisonous, hence the necessity of care in the use of copper utensils for culinary and domestic purposes. It is readily detected in solution by the bright blue produced by the addition of liquid ammonia—by the brown precipitate formed by the ferrocyanate of potash—or by its speedily coating a slip of polished iron or steel (a knife-blade, for example) with a thin film of metallic copper. Copper is largely employed in the arts and industry of all civilised nations, either alone or as an alloy—bronze, brass, bell-metal, and gun-metal being some of its most important admixtures.

Cópperas (Ger. *kupfer-wasser*).—The familiar term for sulphate of iron. The sulphate of copper occurs in blue, and the sulphate of iron in green crystals; hence apparently the term *cópperas*. It is prepared by moistening the pyritous shales (sulphurets of iron) which are found abundantly in the Coal-measures, &c., and exposing them to the air, when decomposition takes place and the sulphuret is converted into the sulphate of iron, which is subsequently dissolved and evaporated, to procure it in the crystallised state. It is largely used in dyeing and tanning; in the manufacture of writing-ink, prussian-blue, sulphuric acid; and in various other arts and processes.

Copper-Glance.—A valuable but rather scarce ore of copper (the disulphide), occurring most frequently in blackish lead-grey prismatic (six-sided) crystals, but also massive and amorphous. Copper-glance is lamellar in structure, sectile and soft, slightly malleable, and much more easily fusible than copper. Specimens from Cornwall were found to consist of 77.16 copper, 20.62 sulphur, and 1.45 iron.

Copper-Nickel.—Known also as *nickeline*; a native arseniuret of nickel, generally occurring in veins in the crystalline and transition rocks, associated with cobalt, silver, and other ores. It derives its name from its light copper-red colour, and is used as an ore of nickel in the manufacture of German silver.

Cóprolites (Gr. *kopros*, dung, and *lithos*, stone).—Petrified excrements or dungstone. Coprolites are found in all the Secondary and Tertiary strata, and appear to be the voidings chiefly of saurians and sauroid fishes. In many instances they contain fragments of scales, shells, &c., the undigested portions of the prey of these voracious creatures. Many specimens exhibit on their surfaces the corrugations and vascular impressions of the intestines; and masses of coprolites have been detected *in situ* within the ribs

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of liassic ichthyosauri. Coprolites are found in greatest perfection studying the surfaces of certain argillo-calcareous shales in the Lias and Coal-measures; enclosed as the central nucleus of nodules and balls of ironstone in the Coal-measures; and in those phosphatic nodules of the Greensand and Lower Chalk now used for manurial purposes.

Coral (Gr. *korallion*).—The comprehensive term for all calcareous or stony structures secreted by the marine asteroid polypes or zoophytes. **Coralloid**.—Having the appearance or structure of coral. **Coralline**.—Partaking of the nature of coral.

Coral Rag.—The upper member of the Middle Oolite, so called because it consists, in part, of continuous beds of petrified corals, for the most part retaining the position in which they grew, and sometimes forming masses 15 feet thick.—See OOLITE.

Coral-Reef.—The term applied by naturalists, as well as by mariners, to any connected mass of coral structures, whether trending away in long partially-submerged ledges, encircling islands like breakwater-barriers, or rising as low ring-shaped islets above the waters of the ocean. Such masses are found studing the Pacific on both sides of the equator to the thirtieth degree of latitude; abounding in the southern part of the Indian Ocean; trending for hundreds of miles along the north-east coast of Australia; and occurring less or more plentifully, in patches, in the Persian, Arabian, Red, and Mediterranean Seas. In the Pacific, where volcanic agency is actively upheaving and submerging, coral-reefs are found forming low circular islands, enclosing lagoons (*atolls or lagoon islands*); surrounding islands of igneous and other origin (*fringing or shore reefs*); crowning others already upheaved (*coral ledges*); or stretching along shore in surf-beaten ridges (*the true barrier or encircling reef*) of many leagues in length, and from 20 to more than 200 feet in thickness. Regarding them as mainly composed of coral, and knowing that the zoophytes can add, unless in some very favourable situations, only a foot or two to the structure during a century, many of these reefs must have been commenced before the dawn of the present epoch; and looking upon them as consisting essentially of carbonate of lime, we have calcareous accumulations now in progress rivaling in magnitude the limestones of the Secondary formations.

The composition and construction of coral-reefs, though effected chiefly by lime-secreting zoophytes, seem owing in some measure to the promiscuous aggregation of marine debris. The more abundant reef-builders, according to Darwin, are the *madrepores*, *astræas*, *porites*, *meandrinae*, and *nullipores*, at moderate depths, and the *millepores*, *seriatopores*, and other delicate forms, at depths from fifteen to twenty fathoms—the great field of coral development thus lying between low water and twenty fathoms. As produced by these minute workers, coral is almost a pure carbonate of lime, soft and porous at first, but gradually becoming so hard and compact as to be used in the South Sea Islands for building. During its formation, however, it encloses shells, fragments of drift-coral, sea-weeds, sponges, star-fishes, sea-urchins, drift-wood, and the like; and these being cemented in one mass by the growth of new coral, the drift of coral-sand, and the infiltration of carbonate of lime from decomposed coral, the rock presents a brecciated appearance extremely analogous to some older limestones. Again, the sediment deposited in the lagoons and sheltered water-channels, and which arises from the raspings and droppings of the animals which bore into or browse upon it, produces, when dried and consolidated, a

substance scarcely distinguishable from some earthy varieties of chalk. Further, where reefs have been upheaved by subterranean agency, as the strata of fossil coral on the hills of Tahiti, or enveloped in volcanic tufas, as in the Isle of France, where a bed ten feet thick occurs between two lava currents, the "coral-stone" has a sparry crystalline aspect—thus presenting the geologist with almost every gradation of limestone, from the soft chalky mass of yesterday's secretion to the compact texture of saccharoid marble. On the subject of corals and coral-reefs, the reader may consult Darwin 'On the Structure and Distribution of Coral-Reefs;' Dana in the 'Report on the Geology of the United States Exploring Expedition;' Stutchbury in the 'West of England Journal;' Beechey in his 'Voyage to the Pacific;' and other recent voyagers.

Coral Zone.—In marine zoology, the coral zone, as its name implies, is the region of the calcareous and stronger corals, and extends from 300 to 600 feet—a depth rarely found in true British seas, but where found, characterised by forms of star-fish, cidaris, and brachiopod mollusca, which cannot exist in shallower waters.

Coralline Zone.—That zone of marine life which extends from 90 to about 300 feet in depth, and is, in our latitudes, the great theatre of marine life: the common sea-weeds cease, and corallines luxuriate; the ordinary shore-shells disappear, and buccinum, fusus, trochus, venus, pecten, and the like, abound.

Corax (Gr., a kind of shark-fish).—A genus of shark teeth occurring in the Chalk formation, and differing chiefly from those of the recent genus *Galeus*, to which the *Tope* or Grey Shark belongs, in being solid. They are of small size, of triangular form, with a deep concavity on the posterior margin, the base of which is prolonged, and forms three or four angular points, and have the anterior edge finely serrated. The root of the tooth, as in *Notidanus*, is a broad bony plate.

Coriaceous (Lat. *corium*, a hide).—Having a tough leathery consistence; having the texture of rough skin. Applied to many vegetable and animal substances.

Cornbrash.—A provincial term used by Smith, for a coarse shelly limestone of the Upper Oolite. It is said to derive its name from the facility with which it disintegrates and breaks up (*brashy*) for the purposes of corn-land.—See OOLITIC SYSTEM.

Corncockle Muir, in Dumfriesshire, celebrated for the fossil footprints which occur on the slabs of its Permian sandstones, and which form the subject of Sir W. Jardine's monograph, 'The Ichnology of Annandale.'

Córnean (Lat. *cornu*, a horn).—An igneous rock, so called from its tough, compact, and horn-like texture; known also as *Aphanite*, which see.

Córneous (Lat. *cornu*, a horn).—Horny; having the colour and texture of horn; e.g., the operculum and dried epidermis of many shells, the carapace of the turtle, &c.

Cornish Diamonds.—A name given to varieties of rock-crystal found in the Cornish mines, and frequently cut for ornamental purposes. The true Cornish diamond is usually covered with an opaque coating of silica.

Cornstone.—A term usually applied to the reddish and bluish-red concretionary limestones which occur in the middle formation of the Old Red Sandstone. In Hereford, Fife, and Forfar, they occur associated with reddish marls and sandstones; are often irregular in their stratification;

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are frequently too siliceous to be used as limestones; and are altogether void of fossils. They are said to derive their name from the fertile corn-soil that overlies them in Hereford, as compared with the tenaceous clays which cover the marls and sandstones.

Cornu A'mmonis (Lat. *cornu*, a horn).—An obsolete term for the ammonite, from its fancied resemblance to the horn with which the head of Jupiter Ammon was sculptured.

Cornulites (Lat. *cornu*, a horn).—A genus of ringed or annulated shelly tubes occurring in Silurian strata, and so called from their shape. At one time supposed to be tentacles or encrinal stems, they are now regarded as the shelly tubes of marine annelids.—See **TENTACULITES**.

Corroded (Lat. *corrodo*, I eat or wear away).—Eaten away by degrees; worn away as limestone is by the carbonic acid and moisture of the atmosphere. *Corrosion*, the act or state of being so worn away; and *corrosive*, having the power of dissolving and gradually wearing away.

Corrugated (Lat. *con*, together; *ruga*, a wrinkle).—Wrinkled; covered with irregular folds; having a crumpled and uneven surface.

Corundum, Corundum Stone (Hindoo, *Korund*).—Crystallised alumina or oxide of aluminum, consisting of from 93 to 95 alumina and 3 water, with traces of lime, silica, and magnesia. It usually occurs in six-sided prisms, and also in obtuse and acute six-sided pyramids, but is likewise found granular and massive. It is generally of a greyish or greenish-brown tint; uneven in fracture; tough when compact; and the hardest of all known minerals except the diamond. "The name *corundum*," says Bristow, "is commonly confined to the opaque, rough crystals and cleavable masses, generally of a dingy colour, and often dark; while the term *emery* embraces the more or less impure, massive, granular, and compact kinds; and *sapphire* and *ruby* comprise the transparent, brightly-tinted varieties." It is extensively used for polishing steel and cutting gems.

Coryphodon (Gr. *koryphe*, a point, and *odous*, tooth).—A sub-genus of Lophiodont tapir-like pachyderms found in the Eocene and Miocene Tertiaries of France and England; and so termed by Owen because the angles of the ridges of its molar teeth are developed into points. The broad, ridged, and pointed grinding surface of the tooth indicates its adaptation to comminute the coarser kinds of vegetable substances.

Cósmical (Gr. *kosmos*, order—natural order, as that of the universe).—Relating to the world or universe, as "cosmical laws," or laws of the universe.

Cosmogony (Gr. *kosmos*, world, and *gone*, origin).—Reasoning or speculation as to the origin or creation of the universe. Distinct from Geology, whose object is to unfold the history of our globe as far only as fact and observation will permit of sound deduction.

Cosmography (Gr. *kosmos*, and *grapho*, I write).—A description of the world or universe; the science which treats of the several parts of the world, their laws and relations.

Cosmology (Gr. *kosmos*, and *logos*, reasoning).—The science which treats of the laws that govern the universe; the study of the world in general.

Cósmos (Gr. *kosmos*).—Literally "order;" natural order, like that prevailing in the universe. The whole framework of the material universe; the world, from the orderly arrangement and symmetry of its component parts, in contradistinction to *chaos*, the confused and disorderly mass from which it arose.

Costeining.—In mining, sinking shallow pits at intervals down to the solid rock, and then driving headings at right angles to the general course of the veins in a country, for the purpose of discovering ore.

Cotham Marble.—Known also as *Ruin or Landscape Marble*. A light-grey argillaceous limestone of the White Lias, occurring in thin layers at Cotham and other places near Bristol. Slices of the stone, taken at right angles to the bedding, exhibit, when polished, fanciful representations of landscapes and ruins; hence the name.

Coulées (Fr. *coulée*, to flow as melted metal).—In frequent use by geologists for *streams* of lava, whether in the act of flowing or long since consolidated into rock-material.

Courses.—Applied in geology to thin regular strata from their being superimposed upon one another like the hewn "courses" of a building; hence we hear such phrases as "alternate courses of limestone and shale."

Crag (Celt. *creggan*, shell).—Shelly Tertiary deposits of the Pliocene epoch, occurring in Norfolk and Suffolk, and generally subdivided into three members—viz., the upper or "Mammaliferous Crag," the "Red Crag," and the lower or "Coralline Crag."—See TERTIARY SYSTEM.

Crag and Tail (properly "craig and tail").—Applied to a form of Secondary hills common in Britain, where a bold precipitous front is exposed to the west or north-west, and a sloping declivity towards the east. The phenomenon of crag and tail is evidently the result of the currents of the Drift epoch, which in our latitude swept from north-west to north-east, laying bare the opposing heights, but leaving untouched the sheltered slopes and terraces.

Craigleith Stone.—A compact, fine-grained, free-dressing, whitish-grey sandstone quarried at Craigleith, near Edinburgh, and largely used in the Scotch metropolis as a building-stone. It is almost entirely composed of siliceous sand; the purer beds containing about 98 per cent of silica—the admixtures being carbonate of lime, alumina, and iron.

Cránia (Gr. *kranos*, a helmet or head-piece).—A genus of small brachiopodous molluscs, which attach themselves to other bodies, and consequently have the lower valve flat, and the upper limpet-like or helmet-shaped. They occur from the Lower Silurian to the Chalk inclusive.

Cranium (Lat.).—The skull or brain-case. **Cranial.**—Of or belonging to the skull. In treating of the form of the human skull as a mark of race or tribe, ethnologists are in the habit of speaking of *brachycephalic* or short-headed; *dolichocephalic* or long-skulled; *acrocephalic*, high or pyramidal skulled; and *platycephalic* or flat-headed. As human remains often occur in prehistoric deposits, these terms are also employed by the palæontologist.

Crater (Gr. *krater*, a cup or bowl).—The mouth or orifice of a volcano; so called from its cup or bowl shape. Craters may be central or lateral in the mountain in which they occur; there may be one principal and several subsidiary ones; and they may shift their places and become absorbed by subsidence, or be obliterated by eruptions from more active orifices. The craters of active volcanoes have in general one side a little lower, owing to the prevailing winds carrying the greater portion of the light material (scoriæ and ashes) to the opposite side.—See VOLCANO.

Crateriform.—Applied to hills whose summits present bowl-shaped and other circular depressions that seem to have been the craters of once active volcanoes. We thus speak of the "crateriform hills of Auvergne"—hills

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which were undoubtedly in a state of igneous activity during the Tertiary period.

Creation, Centres of.—See CENTRES OF CREATION.

Creep.—In coal-mining, when the pressure of the superincumbent strata becomes so great as to thrust the “pillars” or masses of coal which are left to support the roofs of the galleries down into the subjacent shales, and thus cause the floors to bulge upwards, this slow bulging is termed a *creep*, and frequently continues till it reaches the roof and entirely chokes up the gallery. The pressing down of the roof, on the other hand, is known as a *thrust* or *crush*, which see.

Cretaceous or Chalk System (Lat. *creta*, chalk).—The Cretaceous system—so called from the chalk beds which form its most notable feature—is the last or uppermost of the Secondary formations. As typically developed in the south of England, it is composed of calcareous, argillaceous, and arenaceous rocks—the former predominating in the upper, and the two latter in the lower portion of the system. The calcareous members are generally known as “chalk” and “chalk-marls,”—the former being applied to the purer beds, and the latter to those that are more earthy and clayey; the argillaceous strata, which are for the most part stiff blue marly clays, are known by the provincial term “gault” or “golt;” and the sandy beds, being frequently coloured green by the presence of chloritic matter, are distinguished as “greensands.” The nodular masses of “flint” that occur in the Chalk consist almost of pure silex, more or less coloured by iron; and the impure calcareo-siliceous nodules and concretions are spoken of as “chert.” The system, as occurring in the south of England, is usually grouped as follows:—

CHALK.	UPPER CHALK.—Generally soft white chalk, containing numerous flint and chert nodules more or less arranged in layers.
	LOWER CHALK.—Harder and less white than the upper, and generally with fewer flints. (Reddish in the north of England, and with abundance of flints.)
	CHALK MARL.—A greyish earthy or yellowish marly chalk, sometimes indurated.
GREENSAND.	UPPER GREENSAND.—Beds of siliceous sand, occasionally indurated to chalky or cherty sandstone (the “fire-stone” of Surrey), of a green or greyish white, with nodules of chert.
	GAULT.—A provincial name for a bluish tenacious clay, sometimes marly, with indurated argillaceous concretions and layers of greensand.
	LOWER GREENSAND.—Beds of green or ferruginous sands, with layers of chert and indurated sandstones, local beds of gault, rocks of chalky or cherty limestone (Kentish rag), and fuller’s earth.

Or, adopting the recent views of palæontologists respecting the cretaceous affinities of the Wealden, and adding certain Continental beds which are wanting in England, we have then an Upper and a Lower group, comprising the following subdivisions:—

UPPER CRETACEOUS.

1. Maestricht beds and Fæos limestones.
2. White chalk, with flints.

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3. Chalk marl, or grey chalk slightly argillaceous.
4. Upper greensand, occasionally with beds of chert, and with chloritic marl (*craye chloritée* of French authors) in the upper portion.
5. Gault, including the Blackdown beds.

LOWER CRETACEOUS (*Neocomian*).

1. Lower greensand—Greensand, ironsand, clay, and occasional beds of limestone (Kentish rag).
2. Wealden beds—or Weald clay and Hastings sands.

Whichever view is adopted, the entire suite of strata—with the exception of the fluvio-marine beds of the Weald—bear evidence of shifting and widespread seas, and of a climate favourable to the growth of cycads and zamias on land, and of corals, gigantic saurians, and turtles in the waters. Palæontologically, the remains of the Chalk and Greensand are eminently marine, and comprise numerous species of sponges, corals, star-fishes, sea-urchins, shell-fish, crustacea, fishes, and reptiles. Indications of bird and mammalian remains have also been detected, but these are as yet too scanty and obscure to warrant any definite conclusion. On the whole, all the Life-types of the system are strictly Mesozoic, and of the numerous species found in the Trias, Oolite, and Chalk, not one, it is affirmed by palæontologists, have been detected in Tertiary strata.

Industrially, the chief products of the system are chalk and flint. Chalk, as an almost pure carbonate of lime, is calcined like ordinary limestones, and employed by the bricklayer, plasterer, cement-maker, and farmer; and levigated, it furnishes the well-known "whiting" of the painter. Flint calcined and ground is used in the manufacture of china, porcelain, and flint-glass; and before the invention of percussion-caps was in universal use for gun-flints. In the south of England flints are extensively used as road-material; and the larger nodules are frequently taken for the building of walls and fences. Beds of fuller's earth are worked in the Greensands, whose indurated strata likewise furnish supplies of not indifferent building-stone and road-material. From the Gault and Upper Greensand of Farnham in Surrey are also obtained those phosphatic nodules, now used as a manure by being ground to powder and converted into the superphosphate by the action of sulphuric acid; as well as that "fire-stone rock," which is said to contain from 30 to 70 per cent of silica soluble in alkalis, and employed in like manner for manurial purposes.

Crinoids, Crinoidea (Gr. *krinon*, a lily, and *eidos*, likeness).—Literally, "lily-like animals;" the Encrinites; an extensive order chiefly of fossil Echinoderms, so termed from the resemblance which their rayed bodies, surmounted on long slender stalks, have, when closed, to a tulip or lily. In existing seas the Crinoids are represented by the *Comatulæ* or "feather-stars" of our own shores, and by the rare and all but extinct *Pentacrinites* of the West Indies. The *Comatula*, though free-floating in its adult state, is attached by a stalk when young; the marsupite, a fossil form, appears also to have been free in its mature state; but all the other families were fixed to the sea-bottom or to other objects by their long, slender, many-jointed stems. The characteristics of the order, which is of vast geological interest, are well exemplified in the *Pentacrinus*, specimens of which are in the British Museum, the College of Surgeons Museum, London, and in the Hunterian Museum, Glasgow. This animal has a long stem or column, which is composed of calcareous joints or ossicles, articulated to each other by radiated surfaces, and is fixed by the base to a rock or other

firm body. The stem, which gives off a number of slender side-branches, supports a vasiform receptacle or cup, formed of five calcareous plates in close apposition; and in this receptacle the digestive and other viscera are situated. The upper part of the receptacle is covered by a plated integument in which there is an aperture for the mouth. From the margin or brim of the receptacle, or pelvis as it is sometimes termed, proceed ten many-rayed arms which subdivide into branches of extreme tenuity. On the upper and inner side of the arms are numerous articulated feelers or pinnæ capable of expansion and contraction, for the capture of prey. In fact, the pentacrinite may be described, without much error, as a stalked comatula, and this designation of "stalked star-fishes" is more or less appropriate to the entire order of Encrinurites. The innumerable calcareous joints which constitute the skeleton of the pentacrinite are held in vital union partly by a fleshy investing integument, and partly by the central perforation which connects the stalk and all the other members with the receptacle containing the viscera or body of the animal. Such is the *Pentacrinus*, and such, in general terms, is the whole of the order—the main differences lying in the stems, which are round and smooth in the *Encrinurites* proper, and pentagonal and ornamented in the *Pentacrinites*; some having the stem simple, others branched; some having the joints equal and similar, others having them large and small alternately; some having the plates of the receptacle larger and more numerous than others; some having the arms in few bifurcations, others having them in many branches, and armed with innumerable feelers. On these and similar distinctions are founded such families as the *Apiocrinites* or pear-encrinurites, the *Cyathocrinites* or cup-encrinurites, and others which appear in the usual subdivisions of the order.—See ENCRINURITES.

Geologically, the Encrinurites range from the Silurian up to the present epoch—most abundantly in Palæozoic and Mesozoic strata, rarely in Cainozoic, and now represented only by *comatula*, and the all but extinct *pentacrinus*. Like the corals, their function seems to have been, to a great extent, the secretion of lime from the ocean—whole strata of limestone, Silurian and Carboniferous, being almost entirely made up of their remains. As in other life-forms, each epoch has had its own peculiar genera and species, and thus we rise from the *platycrinites*, *poteriocrinites*, *cyathocrinites*, and *actinocrinites* of the Palæozoic formations, to the *pentacrinites*, *apiocrinites*, and *marsupites* of the Mesozoic, as certainly as we pass from these to the *comatula* of existing seas.—See tabulations, "ANIMAL SCHEME."

Criocéras, Crioceratite (Gr. *krios*, a ram, and *keras*, horn).—A genus of the Ammonite family peculiar to the Gault and Greensand, and so named from its shape, the whorls being separate, like the coils of a ram's horn.

Crocodylia.—A well-known group or order of reptiles, represented by the crocodiles, gavials, and alligators of existing rivers. They have their body supported on four partially webbed feet, and encased in an armour of bony plates or scutes, hence they are said to be *loricated* or mailed. Crocodylians occur fossil from the Lias upwards; but those occurring up to the Chalk inclusive differ from existing genera in the character of their vertebrae, which are either doubly flat, doubly concave (*amphicoelian*), or convex before and concave behind (*opisthocælian*); while in recent species, and in those occurring in Tertiary strata, the vertebrae are concave in front and convex behind (*procelian*). Besides these differences, the genera having

broad muzzles, like the cayman and alligator, are unknown below the Tertiary formations—all the Secondary genera being referable to the division having elongated beaks, like the recent gavia. *Crocodylus*, *alligator*, and *gavialis*, are recent and Tertiary genera; *goniopholis*, *teleosaurus* *steneosaurus*, &c., are those found in the Chalk and Oolitic formations.

Crocoisite (Gr. *krokoeis*, aurora-yellow).—Monochrome of lead, consisting, according to Berzelius, of 68.5 oxide of lead and 31.5 chromic acid. Occurs in narrow veins in gneiss and the older crystalline rocks, either crystallised in oblique rhombic prisms, or massive; colour, various tints of hyacinth red; streak, orange-yellow. Used as a pigment.

Crop.—The edge of any inclined stratum when it comes to the surface is called the *crop* or *outcrop*, which see.

Cross-Course.—A miner's term for a vein or lode which intersects at right angles (literally *crosses*) the general direction of productive metalliferous veins in any mining district.

Cross-Cut.—In mining, a level driven at right angles to the known direction of a lode with a view to intersect it.

Cross-Stone.—A synonyme of *Harmotome* or *Staurolite*, one of the Zeolite family—either of which see.

Crotalócrinus (Gr. *krotalon*, a child's rattle).—An Upper Silurian encrinite, so called from its very peculiar shape and structure. In most encrinites, the arms issue immediately from the edge of the pelvic cup, commencing with a single joint, and soon branching into two, three, or four; the subdivisions varying in different species. But in this genus the subdivisions commence at the very edge of the cup, and become so numerous as to form a perfect network—the five primary reticulate arms overlapping each other, and forming, as it were, a convoluted funnel-shaped organism of the finest basket-work, instead of the rayed arrangement of the common encrinite. The stem was made up of close tuberculated joints—each tubercle near the root lengthening into tubular processes for attachment to shells and corals.

Crow-Coal.—A miner's term for certain earthy coals which contain very little bitumen and a large percentage of indestructible ash.

Crush.—Applied in mining to any breaking or crushing down of strata by superincumbent pressure, as, for example, the breaking down of the roof of a gallery. The upward bulging of the floor from the same cause is termed a *creep*, which see.

Crustacea (Lat. *crusta*, a hard covering or crust).—Literally "crust-clad;" an extensive and varied class of the Articulata or jointed animals, comprising such well-known forms as the crab, crayfish, lobster, shrimp, and prawn. In very general terms they may be described as free animals, having articulated or segmented bodies, jointed limbs, a branchial or gill respiration, a double or complete circulation of blood, which is colourless, a nervous system consisting of chains of ganglions more or less numerous, the sexes distinct, and reproduction by ova or eggs. In many families the crust or covering, to which the class owes its name, is tough and flexible, and has for its base the peculiar substance termed *chitine*; in others it is hard and stony, and consists mainly of carbonate of lime. Such crusts being incapable of expansion so as to accommodate themselves to the increasing size of the animals, they are *moulted* or cast off at stated periods, and this very frequently during the younger stages—a circumstance which accounts for the infinite numbers of the exuvise of certain families in the

deposits of lakes and estuaries. According to physiologists, the normal number of segments in the Crustacea is twenty-one—seven for the head, seven for the thorax, and seven for the abdomen; but most frequently several of the anterior segments are fused or soldered into a single piece termed the *cephalo-thorax*, leaving the *abdomen* or *post-abdomen* free, and terminated by a variously compounded tail-plate, *telson* or *pygidium*. It is this interfusion of parts which renders the forms of the Crustacean families so varied; and the metamorphoses which many of them undergo, from the larval to the adult stage, that render them so difficult of discrimination. This difficulty is further increased by their great variety of habitat—some living in the ocean, others in lakes and estuaries; some chiefly on land, others partly in trees; some inhabiting the shells and coverings of other animals, and others being parasitic, either for a portion or for the whole of their existence. Their function is also as varied as their habitats—most of them being carnivorous, many of them phytophagous, a large portion omnivorous, while the whole class act less or more as scavengers in clearing away dead and decaying matter.

For these reasons the classification and arrangement of the Crustacea by different systematists differ according to the point of view from which they have been studied. Thus they are often primarily subdivided into ENTOMOSTRACA (within shells) and MALACOSTRACA (soft shells)—the former embracing those small forms (*cypria*, *nebalia*, &c.) which are often partially or wholly enclosed in a bivalvular shell-like carapace; and the latter the larger forms (crayfish, lobster &c.), originally termed “soft-shells,” in comparison with the true testacea or shell-fish. Again, viewing them in reference to their organs of motion, we have such orders as *Copepoda* (oar-footed), *Phyllopoda* (leaf-footed), *Pacilopoda* (various-footed), and the like, according as these members are more especially fitted for swimming, walking, or prehension. Farther, looking at the position of the eyes in the Malacostraca, we have *Podophthalmia* (stalk-eyed), and *Edriophthalmia* (sessile-eyed); at their limbs, and we have *Decapoda* (ten-footed), *Isopoda* (equal-footed), and so forth; or at their caudal terminations, and we have *Macrura* (long-tailed), like the lobster, *Brachyura* (short-tailed), like the crab, and *Anomura* (tailless), like the hermit-crab. These and similar subdivisions show at once the multiplicity and complexity of form in the class—a complexity which is greatly increased by the discovery of widely-divergent fossil forms for which new subdivisions and families have had to be erected.

Geologically, the Crustacea are of prime interest and importance. They occur in the oldest as well as in the most recent formations; the extinct forms have greatly enlarged our conceptions of vitality; and their occurrence in particular strata, and often in inconceivable numbers, enables us to reason on their uniformity of function, even when their forms and organisation appear to be altogether different. The more ancient forms—*trilobites* and *eurypterites*—have now no representatives, and resemble rather the larval than the adult form of any existing genus; in the Mesozoic forms—*glyphaea*, &c.—we catch a glimpse of the existing long-tailed decapods; and not till we ascend to upper Mesozoic and Cainozoic strata do we discover the more concentrated structures of the short-tailed crabs and their congeners.—For structural and systematic arrangements, see tabulations, “ANIMAL SCHEME.”

Cryolite (Gr. *kruos*, hoar-frost, and *lithos*).—The double hydrofluat of

soda and alumina, a rare mineral found only in the Gneiss of West Greenland, where it occurs in thick veins, massive, and of a lamellar structure. There are two varieties, the snow-white and the rusty-yellow; and both are now used as the commercial ore of *aluminium*. Cryolite melts like ice in the flame of a candle; hence the name.

Cryptogamia, Cryptogamic (Gr. *kryptos*, concealed, and *gamos*, nuptials).—Literally, flowerless; one of the great divisions of the vegetable kingdom, comprising the mushrooms, lichens, mosses, sea-weeds, and ferns, in which the organs of fructification are concealed or not apparent, as in the *Phanerogamia* or flowering plants. They are also termed *agamous*, *acotyledonous*, and *cellular plants*. Fossil in all formations.—See tabulations, "VEGETABLE SCHEME."

Crystal (Gr. *krystallos*, ice).—Originally applied to transparent gems, but now extended to all minerals having regular geometrical forms. **Crystallised**.—Having the structure of a crystal, as rock-crystal. **Crystalline**.—Confusedly crystalline, as granite. **Sub-crystalline**.—Indistinctly or faintly crystalline, as some varieties of limestone.—See CRYSTALLOGRAPHY.

Crystallisation.—The process (natural or artificial) by which the particles of liquid or gaseous bodies are converted into *crystals*, or solid bodies of a regularly limited form; e.g., the production of common salt by the evaporation of sea-brine, of sugar-candy by the evaporation of syrup. In mineral or unorganised bodies the ultimate or component particles are polygonal solids or crystals; in organised bodies they are hollow spherical cells. As in the organic world, therefore, every variety of structure is but the result of modifications of the primitive *spherical cell*; so in the inorganic world every rock and mineral is composed of original *angular solids*, or determinate modifications of these. Why calcareous spar should assume one form of crystal, and quartz or rock-crystal another, science cannot tell; but must, in the mean time, content itself with the determination and description of these curious and multifarious forms.

Crystallography (Gr. *krystallos*, and *grapho*, I write).—Literally, a description of crystals; that sub-science of mineralogy which investigates the relation of crystalline forms, and the origin and structure of crystals. "The word *crystal* in mineralogy designates a solid body, exhibiting an original (not artificial) more or less regular polyhedric form. It is thus bounded by plane surfaces named *faces*, which intersect in straight lines or *edges*, and these again meet in points and form *angles*, which, when bounded by three or more faces, are named *solid angles*. The space occupied by a crystal, and bounded by its faces, is often named a *form of crystallisation*, which is thus merely the mathematical figure regarded as independent of the matter that fills it. Some crystals are bounded by equal and similar faces, and are named *simple forms*; whilst those in which the faces are not equal and similar, are named *compound forms* or *combinations*—being regarded as produced by the union or combination of the faces of two or more simple forms. The cube or hexahedron bounded by six equal and similar squares, the octahedron by eight equilateral triangles, and the rhombohedron by six rhombs, are thus simple forms. The *axis* of a crystal is a line passing through its centre, and terminating either in the middle of two faces, or of two edges, or in two angles; and axes terminating in similar parts of a crystal are named *similar axes*. In describing a crystal, one of its axes is supposed to be vertical or upright, and is then named the *principal axis*. When the axes of the crystals are

properly chosen, and placed in a right position, the various faces are observed to group themselves in a regular and beautiful manner around these axes, and to be all so related to them as to compose a connected series produced according to definite laws. It appears that every mineral species is characterised by a certain form of crystal, with axes intersecting at fixed angles, and bearing to each other definite proportions, from which as a primary every other form of crystal observed in that mineral species may be deduced, simply by varying the proportion of these axes. When viewed in this manner, and referred to their simplest forms, it is seen that the innumerable variety of crystals occurring in nature may be all reduced to six distinct groups, or, as they are named, *systems of crystallisation*. According to Naumann, these systems are the Tesseral, Tetragonal, Hexagonal, Rhombic, Monoclinohedric, and Triclinohedric; and a description of these, with their combinations and derivations, constitutes the main portion of Crystallography. In a description of these systems, the crystals are supposed to be *perfect*; that is, the planes smooth and even, and the faces equal and uniform. A perfect crystal can only be produced when during its formation it is completely isolated, so as to have full room to expand on every side. These conditions, however, seldom occur in nature; hence we have *imperfect* crystallisation—that is, crystals terminating abruptly, having their faces striated, rough, and drusy, their edges curved, and their corners rounded. Amid all these changes and modifications, however, one important element remains unchanged—viz., their *angular measurement*. This is obtained either by the contact, or by the reflecting *goniometer*.—"(*Manual of Mineralogy, passim.*) So far the determination of crystalline forms and species is strictly *mathematical*, and Crystallography, properly speaking, restricts itself to this formation; but as in nature minerals are often irregularly aggregated, and as the great bulk of the rocks have been formed under conditions that excluded the free development of regular crystallised forms, the mineralogist in his discriminations has to call in the aid of physical characteristics, such as *cleavage, fracture, hardness, lustre, and optical properties*—and even these only assume precision and geological importance when guided by the more exact and satisfactory results of *chemical analysis*.—See MINERALOGY.

Ctenis (Gr. *kteis*, *ktenos*, a comb).—A provisional genus of Professor Lindley for certain cycadaceous-looking leaves furnished with narrow pointed leaflets (hence their pectinated aspect), but differing from cycads in having their veins bifurcating instead of undivided and parallel.

Ctenoid, Ctenoidean (Gr. *kteis*, a comb, and *eidos*, form).—The third order of fishes in Agassiz's arrangement. They are distinguished by their scales, which are jagged or pectinated (like the teeth of a comb) on the posterior margin: these scales are formed of laminae of horn or bone, but have no enamel. The *Ctenoideans* appear with the Chalk; the Perch is a familiar example.—See ICHTHYOLOGY.

Ctenoptérygius (Gr. *kteis*, *ktenos*, a comb, and *ptyche*, a wrinkle).—A genus of palatal fish-teeth belonging to the Cestracant family, and found chiefly in the Carboniferous limestone. They are readily distinguished by the serrated or comb-like margin of their free-cutting edges.

Cube-Ore.—An arseniate of iron, of an olive-green or pistacio-green colour, and occurring in perfect cubes in the copper-ores of Cornwall and other localities.

Cucumites (Lat. *cucumis*, a cucumber).—Fossil fruits from the London Clay, so closely resembling the seeds of various members of the recent genus *Cucumis* (comprising the gourd, water-melon, &c.), both in outward form and internal structure, that there is no reasonable doubt of their belonging to plants of the same family; hence the name *Cucumites*, or fossil cucumbers.

Culm (Welsh).—An impure shaly kind of coal, or anthracitic shale. The culmiferous or anthracitic shales of North Devon are well known in geology, and are sometimes treated as a lower Carboniferous group under the term "*Culm Measures*."

Culmites (Lat. *culmus*, a stem like that of corn).—A provisional genus of Tertiary articulated stems, with two or more scars at the joints.

Cúmbrian (the ancient *Cumbria*).—Professor Sedgwick's term for the lowest slaty and partially-fossiliferous beds of Westmoreland and Cumberland, as indicating an older and earlier system than the SILURIAN of Murchison.—See CAMBRIAN.

Cúneiform (Lat. *cuneus*, a wedge, and *forma*, likeness).—Wedge-shaped; *Cuneate*, tapering like a wedge; a form characteristic of many mineral forms, and abruptly terminating stratiform masses.

Cupressinites (*cupressus*, the cypress-tree).—A genus of fossil fruits occurring in Tertiary strata, and evidently allied to those of the existing cypress. Known also as *Callitrites*, *Frenilites*, and *Solenostrobus*.

Cupressites.—The generic term employed by Brongniart for all coniferous remains that are nearly allied to, or identical with, the existing cypress. Their leaves are enlarged at the base, sessile, and inserted spirally in six or seven rows; their fruit consists of peltate scales. They have been found in the Trias, Lias, Oolite, and Wealden.

Cupriferous (Lat. *cuprum*, copper, and *fero*, I bear).—Applied to veins, rocks, and other matrices containing the ores of copper, or copper in the native or metallic state.

Cuprite (Lat. *cuprum*, copper).—A mineralogical term for the *red oxide of copper*, known also as *octahedral copper ore*, from the form of its crystals, which are usually attached and combined in druses. It also occurs in granular or compact aggregates, has a metallic-adamantine lustre, a cochineal or shining red colour; and consists of 88.5 copper and 11.5 oxygen. It is found in beds or veins, in granite, in the crystalline schists and transition rocks, and usually along with other ores of copper, blende, galena, and pyrites.

Cuproplumbite (Lat. *cuprum*, copper; *plumbum*, lead).—Literally *copper-lead*, a massive-granular grey ore with a cubic cleavage, chiefly obtained from Chili, and consisting of 64.9 lead, 19.5 copper, 0.5 silver, and 15.1 sulphur.

Cursóres (Lat. *curro*, I run).—Runners or Coursers. An order of birds, so named from the peculiar adaptation of their legs and feet for running. The order includes the ostrich, emu, cassowary, and apteryx, in all of which the wings are merely rudimentary and unfitted for flight. Remains of gigantic *cursorial* birds (*Dinornis*, *Epiornis*, &c.) have been found in the Upper Tertiary and Newer Pleistocene formations.

Cúspidate (Lat. *cuspis*, a spear).—Spear-shaped; tapering abruptly to a stiff short point, in contradistinction to *lanceolate*, which indicates a slender and slowly tapering form.

Cutters.—A quarryman's term for any narrow crack or fissure that cuts

or crosses the strata; hence "backs and cutters," for what is known to geologists as the *jointed* structure.

Cyanite (Gr. *kyanos*, azure blue).—One of the Garnet family, occurring in broad prismatic crystals, chiefly in mica and talc schists, and so called from its prevailing azure-blue colour. Transparent blue cyanite is often polished and substituted for sapphire, but is easily known from its inferior hardness.

Cyanose, Cyánosite (Gr. *kyanos*, azure blue).—Sulphate of copper, or blue vitriol, a well-known substance, occurring in nature as a secondary production from copper pyrites, or from iron pyrites containing small quantities of copper, but more frequently prepared artificially—either by the roasting and lixiviation of pyrites and other copper ores, by treating these or metallic copper with sulphuric acid, or as a residuary product of metallurgic operations. Used as a pigment and dye-stuff.

Cyáthiform (Gr. *cyathos*, a cup, and *forma*, likeness).—Cup-shaped; having the form of a cup, as certain flowers, polypes, corals, &c.

Cyathophyllum (Gr. *cyathos*, a cup or goblet, and *phyllon*, leaf).—A genus of cup-corals, having a turbinated polyparium or calcareous axis, simple or compound, and internally lamellated; the cells polygonal, radiated, and depressed or cup-like in the centre; whence the name. They are extremely abundant in Silurian strata, in the mountain limestone, and in the coral-rag of the Oolite. The simple turbinated forms are often of considerable size (the *turbinolia* of early authors), and from their shape are known by the familiar term of "petrified ram's-horns."

Cycadoidea.—Literally *cycas-like*; a term which implies merely general resemblance, without hazarding any opinion as to absolute identity. A genus of roundish or oblong stems, covered with densely imbricated scales, and greatly resembling those of the *cycas*. They are found in the Lias, Oolite, and Wealden strata, and afford evidence of a warm genial climate in the latitudes where they occur.—See MANTELLIA.

Cycadites.—Fossil plants of the younger Secondary epochs—Oolite and Chalk—apparently allied to the existing *cycas*. The leaves only are known, and these are pinnated; leaflets linear, entire, adhering by their whole base, having a single thick midrib and no secondary veins.

Cyclas (Gr. *kuklos*, a circle).—A genus of fresh-water bivalves, having oval, transverse, equivalved shells, with the hinge-teeth very small; the substance of the shell thin and fragile. The species occur recent, and in the Tertiary and Wealden formations. In the older formations many organisms formerly regarded as *Cyclas* are now known to be *Estheria*, a bivalved entomostracous crustacean, which see.

Cycle (Gr. *kuklos*, a circle).—Literally a circle of time, like the revolution of the year and seasons; a periodical or recurrent space of time. Often loosely employed for periods of indefinite duration.

Cyclocládia (Gr. *kuklos*, circle, and *klados*, branch).—A name given to certain Coal-measure plants, consisting of detached whorls of circular leaf-scars, each scar being about half an inch in diameter, and deeply pitted.

Cýcloid, Cycloidean (Gr. *kuklos*, a circle, and *eidós*, form).—The fourth order of Fishes in Agassiz's arrangement. They are distinguished by their scales, which are rounded, smooth and simple at the margin, and often ornamented with various figures on the upper surface: these scales are composed of laminae of horn or bone, but have no enamel. The *Cycloi-*

deans are chiefly Tertiary and recent species; the salmon and herring are examples.—See ICHTHYOLOGY.

Cyclône (Gr. *kuklos*, a circle).—A term applied by navigators to those rotatory hurricanes which occur most frequently between the equator and the tropics, and near the equatorial limit of the trade-winds. They sweep round and round with a progressive motion, their course describing a curve, and their violence being greater the narrower the limit of their whirl. In both hemispheres the rotation of a cyclone is *contrary* to that of the sun; those in the northern hemisphere moving counter, so to speak, to the motion of a watch-hand, those in the southern following that motion.

Cyclópteris (Gr. *kuklos*, a circle, and *ptéris*, fern).—An extensive genus of fern-like plants, ranging from the Devonian to the Oolite inclusive; and so called from the rounded or circular shape of their leaflets, which are entire, have no midrib, but are thickly marked with dichotomous veins which radiate from the base to the margin.

Cýmbiform (Lat. *cymba*, a boat, and *forma*, likeness).—Boat-shaped; navicular; having the form of a boat or skiff; as many shells, the glumes of grasses, &c.

Cýmophane (Gr. *kuma*, a wave, and *phaino*, I appear).—The name given to those semi-transparent varieties of chrysoberyl which display a peculiar milky or opalescent appearance. When cut *en cabochon* they exhibit a white floating band of light; hence the name.

Cynochámpsa (Gr. *kyon*, dog, and *champsai*, crocodile).—A genus of Crocodilian reptiles, founded by Professor Owen on remains from the sandstone rocks of Rhenosterberg, South Africa; and so named from the large carnivorous-looking canines that arm the long slender jaws which terminate, as in *Teleosaurus*, in a single nostril.

Cyperites (*cyperacea*, the rush tribe).—Long, narrow, ensiform leaves which occur in the Coal-measures, and so called from their general resemblance to those of the *Cyperus*. According to Lindley, *cyperites*, as a genus, is distinguished by the want of a midrib, and by the presence of parallel lateral veins.

Cypræidæ (Lat. *Cypris*, a name of Venus).—The Cowry family, including the genera *Cypræa*, *Erato*, and *Ovulum*. The Cowries or Porcelain shells are carnivorous gastropods inhabiting the shores of warm seas, and are well known from their convolute, enamelled, and often spotted, barred, and otherwise ornamented shells. In the young the spire is apparent, but in the adult shell it becomes concealed by the last whorl enveloping all the others. They occur fossil from the Chalk upwards, but are not known before that period.

Cypridina-Schiefer.—Slaty bands of limestone occurring, in Belgium and Germany, on the uppermost verge of the Devonian system; and so termed from their containing as their most characteristic fossil the small crustacean *Cypridina serrato-striata*. The "Cypridina-Schiefer" is regarded by M. Sandberger and Sir R. Murchison as the typical rock of the Upper Devonians of the Rhine district.

Cyprinoid (*cyprinus*, a carp, and *eidos*, likeness).—Carp-like; applied to many species of small fossil fishes which occur in the fluviatile and lacustrine deposits of the Tertiary formation, and which, like the living carps, seem to have inhabited fresh waters, or the brackish waters of estuaries. Beautiful specimens are obtained from the Tertiary beds of Oeningen and the marls of Aix—the latter locality also yielding vast numbers of

Cyprinodonts, the recent species of which are also small fishes, inhabiting the fresh-water lakes of temperate zones.

Cypris, Cyprididae.—A genus and family of minute crustaceans, having two enveloping crusts like those of a bivalve shell, but united by a dorsal fold without hinge. They inhabit the waters of lakes, marshes, and estuaries; moult or renew their integuments yearly; and are variously termed and divided by zoologists. Fossil forms under the generic terms of *Cypris*, *Cypridea*, *Cypridina*, *Cyprella*, and *Cypridella*, occur in all rocks from the Lower Coal-measures upwards.

Cystidæ (Gr. *cystis*, a bladder).—A family of Silurian echinoderms, so called from their spherical or bladder-like form: the *sphæronites* of earlier authors. They constituted, in the primeval seas, the representatives of the sea-urchins of the Secondary, Tertiary, and current epochs; and appear to have been sessile, or furnished with a short jointed foot-stalk, and not to have been free-moving, like the *cidaris* and *echinus*. According to E. Forbes, they have affinities with the Crinoids on the one hand (some possessing very perfectly formed arms and tentacles), and with the Sea-urchins on the other; while others also point out affinities to the *Pentremites* of the mountain limestone. The more frequent genera are *Echinosphærites*, *Pseudocrinites*, *Caryocistites*, *Hemicormites*, *Echino-encrinus*, and *Cryptocrinites*.—See CYSTOIDEA.

Cystiphýllum (Gr. *cystis*, a bladder, and *phýllon*, leaf).—A genus of Silurian turbinated corals, externally striated, and internally composed of small bladder-shaped cells, hence the name.

Cystoidea.—Under this title the *Cystidæ* (which see) have been erected by Von Buch and others into a small independent group or "order" of echinoderms. Their leading characteristics are—"a globular body covered with close-fitting polygonal plates and attached by a simple jointed stem; mouth minute and opposite to the stalk; close to it is the small anal opening; and a little more distant the generative orifice, covered by a pyramid of five or six little valves. Some genera, like *Pseudocrinus*, have two or four tentaculiferous arms, bent down over the body and lodged in grooves to which they are anchylosed; others, like *Sphæronites*, have only obscure indications of tentacles situated close to the mouth."

Cytherids.—A family of Entomostraca, or minute bivalve crustaceans, occurring in every formation; but most abundantly in the genera *Cythere*, *Cythereis*, and *Cytherella* in the Chalk and older Tertiaries. There are doubts as to the precise affinities of the so-called Palæozoic species.

D

Dadóxylon (Gr.).—Literally "pine or torch-wood;" Endlicher's generic term for fossil wood whose structure is apparently identical with that of the living species of *Araucarias*; same as *Araucarites*, which see. Wood of this structure is common in the Lias, Oolite, Wealden, and Chalk.

Damps.—A miner's term for the gaseous products that are eliminated in coal-mines—carbonic acid being *choke-damp*, from its extinguishing life and flame, and light carburetted hydrogen being *fire-damp*, from its exploding when brought in contact with flame.

Dapedius (Gr. *dapedon*, a pavement).—A genus of ganoid fishes peculiar to the Lias, and so named from the arrangement of the rhomboidal scales resembling a tessellated pavement. The Dapedius is a wide, laterally-compressed fish, with a rounded head, fins of moderate size, and body rapidly contracting, and terminating in an equally-lobed tail. The mouth is furnished with several rows of small conical teeth, crenated at their summits, and has brush-teeth on the palatine bones.

Darwinitz.—An arseniate of copper occurring in thin veins in the porphyritic claystones of Chili and Peru, and named after Darwin in honour of his geological researches in South America. It is found massive, of a dark silver-grey, high metallic lustre, rather brittle, and consists of 88.07 copper, 11.69 arsenic, and 0.24 silver.

Dasyceps (Gr.)—Literally "rough-head;" a provisional genus of labyrinthodont reptiles occurring in the Bunter Sandstein or Permian formation of Warwickshire. Beyond the cranium and teeth nothing further is yet known of the genus.

Dasyops (Gr. *dasy*, hairy or rough, and *pous*, a foot).—The zoological term for the Armadilloes, in allusion to the common character of their feet, the soles of which are covered with strong hairs, and on which they walk, with their claws expanded. The armadilloes are edentate, that is, possess only grinders; are covered with a cuirass composed of strong horny rings; are nocturnal, live in burrows, and prey alike on animal and vegetable substances. They inhabit the warmer parts of South America, in the Upper Tertiaries of which are found the remains of the *Glyptodon*, and other extinct congeners.

Datholite or **Datolite**.—A siliceous borate of lime, forming one of the Fluor-spar family, and occurring in various formations, in druses and in coarse granular masses. It consists of 38.3 silica, 21.5 boracic acid, 34.6 lime, and 5.6 water.

Dauk or **Dawk**.—A mining and quarry term for bands and beds of tough, compact, sandy clay.—See **DOUK**.

Davite.—In honour of Sir Humphrey Davy.—A native sulphate of alumina, of a yellow or greenish-yellow colour, and nauseous and highly astringent taste. It occurs as a deposit from certain thermal springs, containing free sulphuric acid, near Bogotá in the Columbian Andes.

Davy-Lamp.—A form of lamp invented by Sir Humphrey Davy, and now extensively used in coal-mines subject to explosions of fire-damp. The principles involved in this invention are—*first*, that no mixture of fire-damp with common air, however dangerous, conveys an explosion through tubes or openings, the diameter of which is less than about one-eighth of an inch; and *secondly*, that these explosive mixtures need a much stronger heat for their explosion than mixtures of common inflammable gas, since neither charcoal nor iron at a red-heat will produce this effect, which requires, indeed, that iron be raised to a white heat. Proceeding upon these principles, the light of a lamp is surrounded by wire-gauze, the meshes of which are from $\frac{1}{16}$ to $\frac{1}{8}$ of an inch; and through these, any explosions that may take place inside the lamp are not communicated to the outside, so that the miner can pursue his calling with the light of a "Davy" in workings which would otherwise be unapproachable. There are several modifications of the Davy-lamp; but in all, the fundamental principles are the same.

Deads.—In mining, any vein-stone or mine-stuff, broken underground,

that does not contain enough of ore to make it worth removing for dressing; mine waste; mine rubbish.

Débacle (Fr. *débâcle*, to unbar).—A term originally signifying the breaking-up of the ice on a river—a freshet; but now applied to any sudden flood or rush of water which breaks down opposing barriers, and hurls forward and disperses blocks of stone and other debris.

Débris (Fr., wreck or waste).—A convenient term, adopted from the French, for any accumulation of loose material arising from the waste of rocks; also for drifted accumulations of vegetable or animal matter.

Decápoda (Gr. *deka*, ten, and *pous*, *podos*, foot).—Literally ten-footed; the highest order of crustacea, including all the stalk-eyed families, in which the whole of the thoracic segments are united with those of the head into a single piece (the *cephalo-thorax*), encased in a common crust, with no traces of segmentary division (the *carapace*); and which have the branchial organs enclosed within a cavity on each side the cephalo-thorax. The true thoracic legs are almost always ten in number, whence the name of the order. The order includes three subdivisions—the *Macrura*, or long-tailed, such as the crayfish; the *Brachyura*, or short-tailed, as the common crab; and the *Anomura*, or tailless, as the hermit-crab.

Decomposition (Lat.).—Literally “set free from composition:” the resolution of compounds into their elements, or the alteration of their chemical constitution in such a manner that new products are formed. Thus, we speak of *decomposing granite*, when its particles of quartz, felspar, and mica fall asunder under the action of the atmosphere; and of the further *decomposition* of the felspar when it becomes converted into clay, and the soda, potash, and iron with which the clay was combined are set free.

Decorticated (Lat. *de*, from off, and *cortex*, the bark).—Having the bark, skin, husk, or other integument removed or stripped off. Thus, many fossil plants have their bark converted into a thin pellicle of coal, and accordingly their leaf-scars or external sculptures present very different aspects according as the specimens retain their bark or are *decorticated*.

Decrépitate (Lat. *de*, and *crepito*, to make a crackling noise).—To fly in particles with a crackling noise when exposed to heat, as common salt and many other mineral substances do when they thus part with their water of crystallisation.

Deflagration (Lat. *de*, from, and *flagro*, to burn vehemently).—The sudden combustion of any substance for the purpose of producing some change in its composition by the joint action of heat and oxygen. The process is commonly performed by *projecting* into a red-hot crucible, in small quantities at a time, a mixture of about equal parts of *nitre* and the *body to be oxidised*.

Degradation (Lat. *de*, down, and *gradus*, step).—Removing or wasting down step by step. The degradation of hills and cliffs is caused by atmospheric and aqueous agency; hence water is said to exert a *degrading* influence on the earth's crust; waves and tidal currents a *degrading* action on certain sea-shores. It is usual to arrange degrading causes or agencies into three sets—the *atmospheric*, or those connected with the atmosphere; the *fluvialile*, or those depending on rivers; and the *oceanic*, or those in which the ocean is the immediate agent.

Deinórnis, Dinornis (Gr. *deinos*, terrible or monstrous, and *ornis*, bird).—A gigantic cursorial bird, whose remains (fragments of eggs as well as numerous bones) have been discovered, in a sub-fossil state, in the river-

silts of New Zealand. The affinities of the *Dinornis*, or *Moa* of the natives, are not yet clearly defined, though, according to Owen and Mantell, it has evidently been a wingless cursorial bird of great size and strength—varying from ten to fourteen feet in height, or considerably larger than the existing ostrich, and occurring in several well-marked species. The epoch of the *Dinornis* is strictly Post-Tertiary, and the traditions of the natives would indicate its contemporaneity with the *Apteryx* and *Notornis*—wingless birds which still inhabit these islands. The *Palapteryx*, *Aptornis*, &c., are sub-fossil congeners, found in the same deposits.—See Mantell's 'Petri-factions and their Teachings;' and Owen in 'Zoological Transactions' for 1844-1850.

Deinosaurians, Dinosaur (Gr. *deinos*, monstrous; *saurus*, lizard).—Literally "fearfully-great lizards;" a term employed by Professor Owen to designate an order of terrestrial reptiles peculiar to the upper Secondary formations, and comprising the *Iguanodon*, *Megalosaurus*, and *Hylæosaurus*, which see. As an order, the Dinosauria are characterised by their free vertebrae being flat at both ends, but in some species the cervical become convex in front and concave behind. The limbs are ambulatory, strong, long, and ungulate; and the femur has, in some, a third trochanter. The species are of great bulk, and eminently fitted for terrestrial life—some being vegetable-feeders, like *iguanodon*, and others, like *megalosaur*, being carnivorous.—('British Association Report on Fossil Reptiles,' 1841 and 1850; Dr Mantell's various works.)

Deinotherium (Gr. *deinos*, terrible, and *therium*, wild beast).—A huge proboscidean mammal found in the Miocene Tertiaries of Europe and Asia. The zoological position of the *dinother* (of which there seem to be several species) is not yet distinctly ascertained—the skull, molar teeth, scapular bone, and pelvis being the only portions yet discovered. From these it appears that the animal was furnished with a short proboscis like the tapirs; lived on vegetable food, like the tapirs and lamantins; and had the lower jaw armed with two enormous tusks, depressed downwards, and gently curved inwards. Professor Kaup regards the *Dinother* as intermediate between the mastodons and tapirs, and truly terrestrial; MM. Blainville and Pictet consider it a herbivorous cetacean which inhabited the embouchures of great rivers, and uprooted with its tusks the marsh and aquatic plants which constituted its food; while M. Solaro, who has recently discovered the pelvis of the animal (nearly 6 feet in diameter, by 4 feet 3 inches in height) in the deposits of the Haute Garonne, believes it to have been *marcupial* and of true terrestrial habits. "The adult dentition of *Deinotherium* (according to Dr Falconer) is characterised by two vertically succeeding premolars, and three true molars—five teeth in all, with transverse crenulated ridges closely resembling those of the tapir; and by two huge inferior recurved incisors, implanted in an enormously thickened and deflected beak, or prolongation of the symphysis of the lower jaw."

Delesseriæ.—A genus of fossil Algæ (chiefly Tertiary), so named by Sternberg from their resemblance to the existing *Delesseria*, which has thin, flat or undulated, smooth, membranous fronds, with a median rib.

Deliquescence (Lat. *deliquesco*, to melt away, to become liquid).—The property of certain salts, acids, and alkalies, to become liquid by their gradual absorption of moisture from the atmosphere. Such salts, &c., are said to be *deliquescent*.

Delphinidae (Lat. *delphinus*, a dolphin).—The Dolphin family; a tribe of cetaceans distinguished from the true whales chiefly by the more proportionate size of the head, which in general is about one-seventh of the entire length of the animal. The family includes the dolphins proper, with long slender snouts and numerous conical teeth; the porpoises; the narwhal, &c. Found fossil in the later Tertiary and Post-Tertiary strata.

Delta.—The alluvial land formed at the mouth of a river, such as that of the Nile, which received this name from the resemblance of the space enclosed by the two main branches of the river to the Greek letter Δ, *delta*. The deltas of many existing rivers, such as the Mississippi, Niger, Ganges, &c., present the inquirer with the most instructive, perhaps, of geological phenomena—exhibiting in their magnitude, the variety of their composition, alternation of their beds, and the entombment of plants and animals, the perfect analogues of many of the older formations. **Deltic**.—Of or belonging to a delta. **Deltoid**.—In the form of the Greek letter Δ; resembling a delta.

Déndrachate (Gr. *dendron*, tree, and *achates*, agate).—Arborescent agate; moss-agate; agate exhibiting in its sections the forms or figures of vegetable growths.

Dendrépeton (Gr. *dendron*, a tree, and *erpeton*, a lizard).—A small lizard-like reptile, discovered by Mr Dawson and Sir C. Lyell in the Lower Coal-measures of Nova Scotia; so named from its being found in the interior of a fossil trunk, and thence supposed to have been of arboreal habits.

Dendritic (Gr. *dendron*, a tree).—Applied to certain branching moss-like appearances which occur on the surfaces of the fissures and joints in rocks. They are apt to be mistaken for fossil vegetation, but are strictly inorganic, and of chemical origin—as much so as the dendritic frost-work of a winter's night on the surface of a window-pane.

Déndrodonts (Gr. *dendron*, a tree, and *odous*, tooth).—An extinct family of fishes, characteristic of the Old Red Sandstone or Devonian system; and so called from the section of their seemingly simple conical teeth, which presents numerous fissures radiating or *spreading like the branches of a tree* from a central mass of “vasodentine,” or vascular uncalcified tissue.

Déndrolite (Gr. *dendron*, tree, and *lithos*, stone).—Fossil wood; a general term for any fossil stem, branch, or other fragment of a tree.

Density (Lat. *densus*, thick, set close).—That property of bodies which relates to the comparative compactness or closeness of their component particles or molecules—bulk for bulk, the denser being the heavier. As gravity is thus in proportion to density, the specific gravity of bodies is taken as the measure of their densities.—See GRAVITY, SPECIFIC.

Dental Formula.—A notation now generally used by zoologists to denote the number and kind of teeth of a mammiferous animal—the teeth forming one of the elements in its generic character. Thus, the dental formula of Man is, incisors $\frac{2}{2}$; canine $\frac{1}{1}$; premolars, $\frac{2}{2}$; molars, $\frac{3}{3}$ = 32; or placing them as they occur on each side of the incisors, $\frac{2}{2}$, $\frac{1}{1}$, $\frac{2}{2}$, $\frac{3}{3}$ —which signifies that there are 4 incisors in either jaw, with 1 canine, 2 premolars or false molars, and 3 molars on either side of these incisors, both in the upper and in the lower jaw. In other words, the incisors being taken as the centre, the upper figures refer to the upper jaw in either side, and the lower figures to the lower jaw.—See TEETH.

Dentine (Lat. *dens*, tooth).—The tissues that compose the teeth in vertebrate animals are arranged by anatomists into *dentine*, which forms the body of the tooth; *cement*, which forms the outer crust; and *enamel*, which (when present) is situated between the dentine and cement.

Dentition (Lat. *dens*, a tooth).—The period at which the teeth of mammalia makes their first appearance through the gums; also the character and arrangement of the teeth in different families, which becomes a most important aid to the palæontologist in the discrimination of fossil species.

Denudation (Lat. *de*, down, and *nudus*, naked).—Laying bare by removal. The removal of superficial matter, so as to lay bare the subjacent strata, is an act of denudation; so also the removal by water of any formation, or part of a formation. We thus speak of *denuded* rock-surfaces, and of strata destroyed or removed by *denudation*. Before a current of water can lay down a quantity of matter in one place, it must manifestly take it up from another; hence, as a geological operation, denudation must accompany and precede deposition.

Deoxidised, Deoxidated.—Literally, “deprived of oxygen;” disunited from oxygen.

Deposit (Lat. *de*, down, and *positus*, placed).—Applied to matter which has settled down from suspension in water. Mud, sand, &c., are deposits, so also are the shales, sandstones, &c., of older date. Deposits are usually distinguished by the positions in which they occur, or by the agencies concerned in their formation, as fluvial, lacustrine, estuary, marine, &c. The *deposition* of rock-matter is going forward less or more rapidly in all waters on the surface of the globe.

Derby-Spar.—A familiar name for fluat of lime or fluor-spar, from its occurring abundantly in the Derbyshire limestones.—See FLUOR-SPAR.

Deroëtis (Gr., a sea-god, so termed from his glittering scales).—A ganoid, eel-like fish of the Chalk formation, belonging to the family of *Plectognathi*, and known to the quarrymen as “petrified eel.” In *Deroëtis* the body is very elongated (often two and three feet long); the head short, with a pointed beak, the upper jaw being a little longer than the lower; and both jaws armed with long, conical, elevated teeth, and several rows of very small ones. On each side of the fish there are three rows of osseous scutes like those of the sturgeon—the rest of the body being also covered with small scales.

Dermal (Gr. *derma*, the skin).—Belonging to the skin; hence we speak of the *dermal* or enveloping integuments of plants and animals.

Dermo-Skeleton (Gr. *derma*, the skin).—The hard integument which covers and affords protection to most invertebrate, and also to many vertebrate animals; the *external* or “exo-skeleton,” in contradistinction to the *internal* or true bony skeleton of the higher animals. It makes its appearance as a tough coriaceous membrane, as shell, crust, scales, horny scutes, &c.; but never as true bone.

Désert.—In geography, applied somewhat loosely to any waste and uninhabited tract of land; but strictly and more especially to wide, open, and comparatively barren tracts, as the Deserts of Africa, Arabia, and Central Asia, which are arid, sandy, and shingly; the desert steppes of Northern Asia, which are partly barren and partly covered with rough grasses; and the desert plains of Australia, which are scrubby and waterless.

Desiccation, Desiccation Cracks (Lat. *de*, and *siccus*, dry).—The drying of solid bodies by the evaporation of whatever moisture they may contain.

Thus clay and clayey beds are *desiccated* by the sun's heat, and as they become dry they shrink and crack in all directions. Were such beds to be overlaid by a new deposit of mud or other soft matter, portions of it would enter these cracks, and the two strata, on being separated (after consolidation) would present—the lower the “mould,” and the upper the “casts” of these fissures. Such appearances are frequent among the strata of all formations, are known as *desiccation cracks*, and are not to be confounded with “joints,” “cleavage,” and similar phenomena.

Detritus (Lat. *de*, down, and *tritus*, rubbed or worn).—An appropriate term for accumulations arising from the waste or disintegration of exposed rock-surfaces. **Detrital** matter may thus consist of clay, sand, gravel, rubbly fragments, or of any admixture of these, according to the nature of the rocks and the amount of attrition to which their particles have been subjected.

Devil's Toe-nail.—A familiar term in some districts of England for the Liassic shell, *Gryphaea incurva*, whose form somewhat resembles a distorted toe-nail.

Devonian.—A common, but not always appropriate synonyme of the Old Red Sandstone, portions of which are extensively developed in Devonshire. The term was introduced by Sir R. Murchison (and harmonises with his “Silurian,” “Permian,” &c.), “because the strata of that age in Devonshire—lithologically very unlike the Old Red Sandstone of Scotland, Hereford, and the South Welsh counties—contain a much more copious and rich fossil fauna, and were shown to occupy the same intermediate position between the Silurian and Carboniferous rocks.”—See OLD RED SANDSTONE.

Dévonite.—A name given by Dr Thomson to *Wavellite*, a phosphate of alumina originally discovered by Dr Wavel in the north of Devonshire.—See WAVELLITE.

Dextral (Lat. *dexter*, belonging to the right hand—right-handed).—This term is usually applied to spiral shells whose whorls, when the mouth is placed towards the observer, turn from left to right; and this is the general course in nature. *Sinistral* or *reversed* shells are those whose spires turn from right to left. In other words, when spiral shells are placed vertically with the spires uppermost, and the mouth towards the observer, the aperture in *dextral* shells is towards the *right*; in *sinistral* it is towards the *left*.

Díabase.—A term adopted from the French, and occasionally applied to those greenstones whose constituents are hornblende and feldspar; same as *Diorite*.

Diaclasite (Gr. *dia* and *klaō*, to cleave through).—A laminated or bladed mineral with the pale colours of diallage passing into brass yellow, but in composition intermediate between diallage and hypersthene.

Diallage (Gr. *diallagē*, interchange).—A siliceo-magnesian mineral, having a laminated or bladed cleavage, and so called from its changeable colour—forms *diallage rock*, and enters into the composition of serpentine. Closely related to *Schiller-spar*, which see.

Díallogite.—Manganese spar, or red manganese; a carbonate of manganese, occurring in crystallised druses, in columnar aggregates, or in granular masses; having a rose-red or flesh-red colour, and glassy pearly lustre. It is found in various formations, but chiefly in veins in gneiss and porphyry along with silver, galena, blende, hæmatite, and other ores.

Diamond (Gr. *adamus*, unsubdued).—The diamond; so called in allusion

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to its unparalleled hardness. The diamond is the most precious of known gems; and, chemically speaking, is carbon or charcoal in its pure and crystallised form. This form is primarily that of a regular octahedron, but of this there are numerous modifications; and the crystals having often curved faces, they more or less approximate to spheres. They occur loose in alluvial sands and gravel; or singly imbedded—in a matrix of sandstone in India, and of mica-slate in Brazil and South America. Geologically, they have been found chiefly in India and Borneo, and the Brazils; more sparingly and in minor crystals in the Urals, in the Carolinas, and in Mexico. The "Diamond Sandstone" of India, and which furnishes the detritus in which most of the specimens are found, is apparently of Tertiary or recent origin; the age of the micaceous schists which yield the diamonds of Brazil and the Urals is unknown. Diamonds are found of all colours; those which are colourless, or which have some very decided tint, are most esteemed; those slightly discoloured are the least valuable. Diamonds are cut and polished only by their own dust or powder—an art known from remote antiquity in the East, but introduced into Europe only about the end of the fifteenth century. They are cut chiefly into three forms—*table*, *rose*, and *brilliant*; the latter having the finest effect, but requiring a greater sacrifice of bulk—some crystals being reduced nearly one half in weight by the operation.

Respecting the origin of the diamond, neither chemistry nor geology has thrown much light on the subject. We know that it consists of carbon in its purest and most concentrated form; but whether this carbon is of vegetable or of animal origin, or whether it may not be a purely chemical elimination altogether apart from organic growth, science has not yet determined. It is true that some observers have thought they detected traces of vegetable structure in the ashes of the diamond, but their observations have not been confirmed; and none of the specimens containing foreign matter have as yet given any hint of their origin. It has been remarked that their occurrence in mica-slate does not favour the idea of their immediate vegetable origin; nor does their occurrence in a soft quartzose sandstone indicate the operation of excessive heat. Indeed, their combustible nature forbids the idea of intense heat in connection with their formation; and yet high heat under pressure, or a long-continued low heat manifesting itself in chemical change, may have effected the crystallisation of carbon in decaying organic matter. Unlike amber, however, diamonds are never found in connection with vegetable or animal substances; so that the primary source of their carbon, as well as the cause of its subsequent crystallisation, remains a mystery.

Diamond Spar.—A familiar term for corundum, which next to diamond is the hardest known mineral.

Diaphanous (Gr. *dia*, through, and *phano*, I appear).—Applied to gems and minerals that may be seen through; transparent; pellucid.

Diatoms, Diatomáceæ (Gr. *dia*, through, and *temno*, to cut asunder).—In botany, a group of microscopic organisms, referred by Ehrenberg to the animalcules, but by most naturalists of the present day to the algae; and so named from the genus *diatoma*, whose frustules are connected together by the angles so as to form a zigzag chain, which looks like a stem cut into several portions. These frustules consist of a single cell, and are invested with a siliceous epidermis; hence deposits of these minute

growths, or "microphytal earths," are *siliceous*, and unlike those of the foraminifera, which are *calcareous*.—See TRIPOLI, MICROPHYTES, &c.

Diceras (Gr. *di*, two, and *keras*, horn).—A massive bivalve of the Upper and Middle Oolites; belonging to the *Chamidae* or Clam-shells; and so termed from its prominent *umbones* or beaks, which are twisted backward in ram's-horn fashion, and furrowed externally by ligamental grooves. There are several species in which the beaks are more or less spiral and horn-like, and the valves less or more unequal. **Diceras Limestone**.—A division of the Oolite in the Alps, regarded by most geologists as the equivalent of the English "coral rag," and so called from its containing abundantly the shells of the *diceras*.

Dichobatus (Gr. *dicha*, divided in two, and *bounos*, a ridge).—A genus of anoplotheroid quadrupeds whose remains occur chiefly in the Eocene or Lower Tertiaries of Europe; so called from the deeply-cleft ridges of the upper molars.

Dichodon (Gr. *dicha*, in two parts, and *odous*, *odontos*, a tooth).—A Middle Tertiary artiodactyle (even-toed) mammal, showing affinities, according to Owen, to the Hog tribe among the non-ruminant section, and to the Camel tribe among the ruminants; so called from the double crescent-shaped lines of enamel on the upper surface of its true molars.

Dichroism (Gr. *dis*, twice; *chroa*, colour).—The property by which a crystallised body assumes two or more colours, according to the direction in which light is transmitted through it; hence the *Dichroite* of Cordier, —a silicate of alumina and magnesia which exhibits three or more colours along its chief axis.

Dicotylédonous (Gr. *dis*, double, and *cotyledon*, seed-lobe).—A grand division of the vegetable kingdom, comprising all those plants whose seeds are composed of two lobes or seed-leaves. They are exogenous, or increase by external layers of growth, and the venation of their leaves is reticulated or net-like, and not in parallel order, as in monocotyledonous endogens.—See tabulations, "VEGETABLE SCHEME."

Dictyophyllum (Gr. *dictyon*, a net, and *phyllon*, leaf).—Literally "net-leaf;" a provisional genus erected for the reception of all unknown fossil dicotyledonous leaves which exhibit the common reticulated structure. *Dictyophylla* have been found as low as the Trias and Permian.

Dictyopteris (Gr. *dictyon*, net; *pteris*, fern).—A genus of Carboniferous ferns established by Gutbier, for those forms possessing the general habit of *Neuropteris*, but differing from it in having a somewhat *radiate-reticulate venation* and *no distinct midrib*.

Dictyopyge (Gr. *dictyon*, net, and *pyge*, anus).—A genus of ganoid fishes, with smooth rhomboidal scales, heterocercal tails, and broad flowing fins, from the Triassic coal-field of Virginia, and so named by Sir P. Egerton from the net-like appearance of the large anal fin. The species vary from four to six or eight inches in length.

Dictynodon (Gr. *di*, two; *cyon*, dog; and *odous*, tooth).—Literally "two canine teeth;" a provisional genus of very peculiar reptiles occurring in a sandstone, supposed to be of Triassic age, in Southern Africa. The principal remains yet found are the bones of the head, which seem to indicate a gigantic type between the lizards and turtles. The eye orbits are very large, the cranium flat, with nostrils divided as in lizards; and the jaws toothless, with the exception that the upper jaw possesses a pair of long

tusks, implanted in sockets and turned downwards like those of the walrus—hence the name *dicynodon*.

Didelphys, Didelphidæ (Gr. *dis*, two, and *delphys*, womb).—The opossum family, so termed from their external abdominal pouch or *marsupium*, in which the fetus is placed after a very short period of uterine gestation, and where it remains (as if in a second womb), suspended to the nipple by its mouth until sufficiently matured to come forth to the open air. Remains of *didelphine* animals occur as early as the Oolitic if not Triassic formation.

Didymium.—One of the rarer metals, of whose properties little is yet known, found along with *lanthanum* in the ores of *Cerium*, which see.

Didymograptus (Gr. *didymos*, twin or double, and *graptus*).—The twin or double graptolite; a common form in the Silurians of Wales and Scotland, having the stems or axes united in pairs. The cells are arranged in single rows as in the common graptolite, but the axes are in twins, or two-branched.

Die-Earth.—A local term at Coalbrook Dale for the Wenlock shale, because this stratum lies beneath all the mining ground of the district—the minerals “dying out,” as it were, at this stage of descent.

Differentiate, Differentiation.—In zoology, the vital functions are said to be more and more “differentiated,” when, instead of several functions being performed by the same organ, each function is performed by an organ specially devoted to it. “Differentiation” is, therefore, a mark of higher organisation—the higher the animal in the scale of being, the more specialised is its organisation.

Digitate (Lat. *digitus*, a finger).—Finger-shaped. Applied to bodies whose parts expand in finger-like process; e.g., the *alcyonia*, or “dead-men’s-fingers” of the sea-shore; the *scorpion strombus*, whose outer lip is armed with strong finger-like spines; the leaves of the horse-chestnut, &c.

Digitigrada (Lat. *digitus*, the toe, and *gradus*, a step).—An extensive tribe of the *Carnivorous* animals, as the lion, tiger, cat, weasel, &c., whose feet are constructed for walking on the toes, and therefore capable of a swift bounding motion, as compared with the slow shuffling walk of the *Plantigrades* (bear, badger, &c.), that set down the entire phalanges of the foot.

Diluvium, Diluvial (Lat. *dis*, asunder, and *luere*, to wash).—Alluvium (which see) has been described as the term usually applied to matter brought together by the *ordinary* operations of water; diluvium, on the other hand, is regarded as implying the *extraordinary* action of water. In this sense it was at one time restricted to those accumulations of gravel, &c., supposed to have been the result of the Noachian deluge; but it has now a wider signification in geology, being applied to all masses apparently the result of powerful aqueous agency.

Diluvialists.—Theorists who regard the boulder-clay, abraded and polished rock-surfaces, ossiferous gravels, and similar superficial phenomena, as the result of the Noachian deluge; in other words, those who ascribe to a universal deluge such superficial results as they cannot readily reconcile with the ordinary operations of water now going on around them.

Dimorphism (Gr. *dis*, two, and *morphe*, form).—“It is sometimes supposed,” says Nicol (‘Manual of Mineralogy’), “that each particular substance can crystallise only in one particular form or series of forms.

Mitscherlich has, however, shown that this is only partially true, and that sulphur, for instance, which usually crystallises in the rhombic system, when melted, may form monoclinohedric crystals. This property is named *dimorphism*, and has been explained by its discoverer on the principle that the form, and with it the other physical characters of a body, depend not merely on the chemical nature of the atoms, but also on their relative position. Hence the same chemical substance may form two, or even more, distinct bodies or mineral species. Thus carbon in one form is the diamond, in another, graphite; and carbonate of lime appears as calc-spar or as arragonite. Even the temperature at which a substance crystallises influences its forms, and so far its composition, as seen in arragonite, Glauber salt, borax, &c."

Dimyaria (Gr. *dis*, twice, and *mys*, a muscle).—That division of the conchiferous bivalves whose shells are closed by two adductor muscles, as the common edible mussel.—See CONCHIFERA.

Diopside (Gr. *dia*, through, and *opsis*, appearance; in allusion to its occasional transparency).—A variety or sub-species of augite, occurring in various shades of greyish-green, and crystallised in broad columnar or concentric lamellar aggregates. A similarly crystallised body has been produced by fusing silica, lime, and magnesia in due proportion.—See AUGITE.

Diopase (Gr., capable of being seen through, in allusion to the natural joints being visible by transmitted light).—Emerald copper, or rhombohedral emerald malachite; occurring in fine emerald-green, transparent, or translucent crystals, and consisting of 38.7 silica, 50 copper protoxide, and 11.3 water. It is found in limestone veins in Tartary, and when first brought to Europe was sold as emerald; but may be distinguished by its inferior hardness, and greater specific gravity.

Diorite (Gr. *dioros*, a clear distinction).—A variety of greenstone, composed of hornblende and felspar, and of a dark colour in consequence of the disseminated plates of hornblende. It receives its name from being unmistakable, in contradistinction to *dolerite*.

Dip.—The inclination or angle at which strata slope or dip downwards into the earth. This angle is measured, of course, from the plane of the horizon or level, and may be readily ascertained by the common spirit-level and plummet, or, as is usual among geologists, by a small pocket instrument called the *clinometer* (which see). The opposite of *dip* is the term *rise*; and either may be used, according to the position of the observer. Thus, standing on the surface, we speak of a bed of coal *dipping to the south*; while at the bottom of the pit, the miner, looking at the same bed, would say that it *rose to the north*. It is usual, on geological maps, to indicate the direction of the dip by an arrow, and the line of outcrop or *strike* of a stratum by a bold line—the one being at right angles to the other.—See STRIKE.

Diplograpsus.—Literally "double graptolite." That section of graptolites in which the cells are arranged in two rows—one on each side the central axis, like the feathers on a quill. The diplograptolites have a foliaceous appearance, and are presumed to resemble the existing *Pennatula* and *Virgularia*.—See GRAPTOLITE.

Diplostylus (Gr.).—Literally "double tail;" a genus of small shrimp-like crustaceans, from the Coal formation of Nova Scotia, and so named by Mr Salter from the two pairs of appendages to the last segment, telson, or tail-plate.

Diprion (Gr. *dis*, two, and *prion*, a saw).—Literally "double saw." A synonyme of *diplograpsus*—the serrated cells on each side the central axis giving the organism the appearance of a double saw.

Diprotodon (Gr. *dis*, two; *protos*, first; and *odous*, tooth).—A gigantic pachydermoid marsupial mammal from the Pleistocene or Upper Tertiary beds of Australia; and so termed from the large scalpriform character of its incisors or front teeth. The head of a specimen now in the British Museum measures three feet in length, and gives some idea of the immense size of the creature, which, while nearly related to the kangaroo, has, according to Owen, "osculant relationship with the herbivorous wombats." The hind limbs are shorter and stronger, and the front limbs are longer and stronger than those of the existing kangaroos.

Dipyre (Gr. *dis*, and *pyr*, fire).—One of the Scapolite family, usually imbedded in slate or limestone, and occurring in rounded eight-sided prisms. Consists of 55.5 silica, 24.8 alumina, 9.6 lime, and 9.5 soda; and is said to derive its name "from its twofold susceptibility to the action of fire. When heated before the blow-pipe it first becomes phosphorescent, and then fuses."

Dirt-Beds.—The name given to certain dark-coloured loam-like beds that occur interstratified with the Oolitic limestones and sandstones of Portland—evidently the soils in which grew the cycads, zamias, and other plants of the period. "At the distance of two feet," says Mr Bakewell, "we find an entire change from marine strata to strata once supporting terrestrial plants; and should any doubt arise respecting the original place and position of these plants, there is over the lower dirt-bed a stratum of freshwater limestone, and upon this a thick dirt-bed, containing not only cycadees, but stumps of trees from three to seven feet in height, in an erect position, with their roots extending beneath them. Stems of trees are found prostrate upon the same stratum, some of them from twenty to twenty-five feet in length, and from one to two feet in diameter."

Discous, Discoid (Gr. *discos*, a quoit, and *eidos*, likeness).—Qwoit-shaped; in the form of a disc; e.g., the shell of the *planorbis*.

Discrase, Discrasite (Gr. *dis*, twofold, and *krasis*, admixture).—Antimonide of silver, a rare ore, consisting of 76 silver and 24 antimony, and so called in allusion to its composition. It occurs in hexagonal prisms, radiated forms, massive, disseminated, and in grains; is of a silver and tin-white colour; metallic lustre, lamellar, brittle, but slightly malleable. It is found in veins in the granitic and crystalline rocks, along with galena, silver, iron-pyrites, and other ores.

Disintegration (Lat. *dis*, asunder, and *integer*, whole).—The breaking asunder of any whole or solid matter. The disintegration of rocks is caused chiefly by the slow action of frosts, rains, and other atmospheric influences; and the facility with which some kinds are acted upon by these influences depends partly on their chemical composition, partly on the aggregation of their particles, and partly on the readiness with which they absorb moisture.

Dislocation (Lat. *dis*, asunder, and *locus*, place or position).—A general term for any displacement of the stratified rocks from their original horizontal or sedimentary position. *Slips, Faults*, and the like, are "dislocations."

Disrupting (Lat. *dis*, asunder, and *ruptus*, rent or broken).—When igneous matter forces its way through the stratified rocks, and fills up the

rents and fissures so made, it is termed *disrupting*; when, having passed through the strata, it spreads over their surface in sheet-like masses, it is said to be *overlying*; and when these discharges have taken place at the bottom of the sea, and have been in turn covered over by new deposits of sediment, they then appear as *interstratified*.

Dithyrócaris (Gr. *dithyros*, having two valves, and *caris*, shrimp).—A genus of phyllopod crustaceans, first discovered by Dr Scouler in the coal shales of Lanarkshire, and so named from its being enclosed, like the existing genus *apus*, in a thin flattish bivalved carapace. The abdominal portion, which is not enclosed in the carapace, consists of five or six segments, and terminates in a trifold tail like *Ceratiocaris*.

Divaricating (Lat. *dis*, asunder, and *varico*, I stride).—Applied to roots, branches, and other members that spread widely and decidedly from each other.

Divining-Rod, Known also in Cornwall and Wales as the *Dowsing-Rod*.—A hazel-rod by the aid of which some persons pretend to be able to tell where water and minerals lie below the surface by a process of divination. The rod is balanced in the hands of the diviner in a peculiar way, and is supposed to indicate the position of the substance sought, by turning towards it with a slow rotatory motion. This superstition is occasionally still practised, and passes under the learned names of *Metalloscopy*, *Hydroscopy*, or *Rhabdomancy*—the last of which see.

Divisional Planes.—A technical term for those lines of separation which traverse rock-masses, and divide them into blocks or fragments, more or less regular. It is usual to speak of them as *congenital*, or those which, like lamination and stratification, are formed at the same time as the rocks themselves; *resultant*, or those arising, like joints, from consolidation and contraction; *accidental*, such as fissures, faults, and veins; and *superinduced*, or those which, like cleavage and foliation, are accompanied by a change in the internal structure of the rocks themselves.

Doab.—The name given in India to the tongue of land that lies between the confluence of two or more rivers, as the *doabs* of the Punjab, or plains that lie between the rivers of that region.

Dodo.—An extinct gigantic bird belonging, as has been shown by MM. Strickland and Melville in their monograph—‘The Dodo and its Kindred’—to the order Columbæ or Pigeons, and constituting the type of a new family (the *Dididae*), to which several fossil species have been ascribed. At the discovery of the island of Mauritius in 1598, the Dodo was still abundant there, and formed a principal portion of the food of the inhabitants; but in the course of a few years it was completely extirpated by the sailors, and its bones are now found only in the silt and tufaceous deposits of that island. A few specimens were, however, brought to Europe in the period which intervened between its discovery and its final destruction, and from these several paintings were made, which, with two heads, a foot, and a few feathers, are now the only proofs of the existence of a large bird which was certainly living within the last two hundred years. The Dodo is described as having been considerably larger than a swan, weighing sometimes fifty pounds; of a very bulky and heavy form; having a strong predaceous bill, hooked at the tip; face or front of the head covered with a naked skin; feet short and stout, but resembling those of a pigeon; wings short, incapable of flight, and composed of soft tufty plumes like those of the ostrich. The *Solitaire*, and other kindred species said to have

recently existed in the islands of the Mauritius, are in like manner extinct; and the nearest living approach to the family now known is the little *Didunculus* of the Navigators' Islands.

Dog's-tooth Spar.—A familiar name given to certain crystals of calcite or calc-spar, from their fanciful resemblance to the tooth of a dog.

Doldrums.—A sailor's term for the tropical zones of calms and variables—belts in which they are often detained for weeks by baffling calms, storms, and rains.

Dolerite (Gr. *doleros*, deceptive).—A variety of greenstone, composed of felspar and augite; so called from the difficulty of discriminating these compounds.—See DIORITE.

Dolichocephalic (Gr. *dolichos*, long, and *kephale*, the head).—Long-headed; e.g., the dolichocephalic or long-skulled tribes of the human family.

Dolichosaurus (Gr.).—Literally "long lizard;" a snake-like reptilian, whose remains, found in the Chalk formation, indicate a creature from two to three feet in length, and probably of aquatic habits. According to Professor Owen, the *Dolichosaurus* presents somewhat of the ophidian character in the number and size of its cervical vertebrae, in the size and shape of its ribs, and in the slender proportions of its trunk and head; but with these partial exceptions, its affinities are truly lacertian.

Dolomite (after the French geologist Dolomieu).—A crystalline, or granulo-crystalline, variety of magnesian limestone, occurring largely in many Secondary formations, and often in the vicinity of igneous rocks, whose heat seems, in most instances, to have been the proximate cause of the superinduced crystalline texture. Ordinary magnesian limestone, though occurring in all stages of compactness, is void of this crystalline texture.—See MAGNESIAN LIMESTONE.

Dômite.—A granular arenaceous-looking variety of trachyte found in the Puy de Dome, Auvergne: hence the name.

Dorsal (Lat. *dorsum*, the back).—Appertaining to the back; as the dorsal vertebrae, or vertebrae of the back; the dorsal fin, or back-fin, &c.

Dounk, Dank, or Daugh (Sax. *deaggan*, to knead).—Applied in mining to beds or bands of hard, tough clay or clayey admixture; generally without lamination, and more or less compact and homogeneous, hence the idea of *daugh* or *dough*.

Downs (Brit. *dune*, a hillock).—Applied in the south of England to the rounded, dry, and unwooded chalk hills of Kent, Surrey, Sussex, and adjacent counties. These "downs" are described as "covered with a sweet, short herbage, forming excellent sheep-pasture, generally bare of trees, and singularly dry even in the valleys that wind for miles between them." Applied also to the low hills of blown sand which skirt the shores of many countries.

Dragons' Skin.—A familiar term among miners and quarrymen for the stems of *Lepidodendron*, whose rhomboidal leaf-scars somewhat resemble the scales of reptiles in their form and arrangement.

Dreelite (after the Marquis de Dree).—One of the heavy spars, generally occurring as a whitish crystallised gangue or vein-stone in the lead-mines of the mountain-limestone, and consisting essentially of sulphate of barytes and sulphate of lime. According to Dufrenoy, a specimen from the lead-mines of Nassière yielded 61.73 sulphate of barytes, 14.27 sulphate of lime, 8.05 carbonate of lime, and 9.71 silica, with alumina and water.

Dressing.—In mining, the "dressing of ores" consists in breaking,

stamping, and washing them so as to separate as much as possible of the stony matrix from the metallic ore.

Drift.—Literally, "that which is driven;" as *sand-drift*, sand driven and accumulated by the wind; *drift-wood*, wood carried down by rivers and driven by tides and currents to distant shores. In geology the word is frequently used as an abbreviated term for the "Glacial Drift," "Northern Drift," or "Diluvial Drift" of the Pleistocene epoch.—See GLACIAL DRIFT.

Drift-Currents.—The name given to oceanic currents which mainly depend on the winds. The monsoons which prevail in the Indian Ocean give rise to drift-currents, which set alternately in one direction and then in another, according to the season of these winds.

Dromatherium (Gr. *dromaïos*, swift-running, and *therion*, beast).—The name given to a small mammal, teeth, jaws, and detached bones of which have been discovered by Mr Emmons in the Red Sandstones of Virginia and North Carolina—strata which, by some, are regarded as Triassic, and by others as the equivalents of our European Permians. Supposed to be, like *amphitherium* and *phascolotherium*, of marsupial affinity.

Drosometer (Gr. *drosos*, dew; *metron*, measure).—Literally "dew-measurer;" any apparatus or instrument for determining the amount of dew deposited during a single night. "The most simple process," says Professor Kaemtz, "consists in exposing to the open air bodies whose exact weight is known, and then weighing them afresh after they are covered with dew. According to Dr Wells, locks of wool, weighing five decigrammes, are to be preferred, which are to be divided into spherical masses, of the diameter of about five centimetres."

Druze (Gr. *drosos*, dew).—A mineralogical term for any hollow space in veins of ore, or vesicular cavity in igneous rocks, like amygdaloid, that is lined or studded with crystals—literally "dewy with crystals;" hence we speak of *druzy* and *sparry* cavities.

Dryopithecus (Gr. *dryos*, a wood, and *pithekos*, ape).—Literally "tree-monkey;" the generic term applied by M. Lartet (1856) to a large species of monkey found in the Miocene beds of the south of France, and apparently related to the modern long-armed apes (*hylobates*). It is supposed to have been a frugivorous, tree-climbing ape, equalling Man in stature.

Ductility (Lat. *ductus*, drawn out).—The property which certain metals possess of being drawn out into wire or thread-like filaments more or less slender. Platinum, gold, and silver, are the most ductile of the metals—a single grain of gold being capable of being drawn into a wire nearly 600 feet in length!

Dune (Brit., a hillock).—Usually applied to hillocks of blown sand. *Sand-dunes*, *sand-drift*, like that which, in so many places, skirts the shores of our own island, Holland, and other countries.

Dunstone.—A local term for certain magnesian limestones of a yellowish dun or cream colour, occurring in the valley of the Derwent, near Matlock, in Derbyshire. They are of a granular texture, extremely hard, and rich in lead and calamine, for which they have been extensively mined.

Dyke (Scott., a wall or fence).—Applied to those wall-like intrusions of igneous rock which fill up rents and fissures in the stratified systems. In general they burst through and displace the strata, though occasionally they merely fill up pre-existing rents and fissures. In dykes composed of

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basalt and basaltic greenstone, the columnar structure is horizontal or at right angles to the stratified walls of the rent or fissure which they occupy. When the matter of the dyke is harder than the intersected strata, and these have been subjected to waste and denudation, the igneous wall-like mass may be traced for miles across a country; and, on the other hand, where the rock-matter of the dyke has been softer, its course may also be traced by narrow wall-sided fissures and linear ditch-like depressions. Both phenomena are well exhibited in the island of Arran.

Dysodile (Gr. *dysodes*, fetid, and *ilys*, mud).—The name given to a bituminous shale or Tertiary mud of a greenish-grey colour, composed of thin papery laminae, and frequently containing the impressions of fish and dicotyledonous leaves. Its bitumen is evidently of animal origin; it burns slowly with much smoke and flame, and emits a highly fetid odour; hence the name.

E

Eagle-Stone.—The *aites lapis* of the ancients, fabled to have been hatched in the nest of the eagle. A variety of nodular argillaceous iron-ore, having a concentric structure, and occasionally so decomposed within as to have a loose kernel which rattles on being shaken. This kernel was known by the name of *callimus*, and was supposed to be the young in the womb of the parent nodule; hence the fable of the *aites* bringing forth young. When there is no internal kernel the nodule becomes simply a *geode*, which see.

Ear-Bones.—The tympanic or petro-tympanic bones of the higher osseous and cartilaginous fishes, as well as those of whales, are of frequent occurrence in a fossil state in the Crag of Norfolk, and other Tertiary strata. They are termed *otolithes* or *otolites*, that is, “ear-stones;” and though varying greatly in size and configuration, are readily distinguished from their bones by their greater density and smooth unattached forms.—See OTOLITES.

Earth.—In chemistry, a solid, opaque, friable substance, without lustre, and incombustible; it is thus distinguished from metals on the one hand, and from carbon and other combustible substances on the other. The *primitive earths* are thus said to be—*baryta*, *strontia*, *lime*, *magnesia*, *alumina*, *glucina*, *zirconia*, *yttria*, *donaria*, and *thorina*. The first four are termed *alkaline earths*, from their partial solubility in water, their alkaline taste, and their action on vegetable colours; the remainder constitute the *earths proper*, are insoluble in water, and only imperfectly neutralise the acids.—In geology, as well as in familiar language, the word EARTH is often loosely employed—the *earths* of the agriculturist being the soils he cultivates, while *fuller's earth* (an absorbent clay), *bone-earth* (phosphate of lime), and the like, are everyday terms. The epithet *earthy* refers more strictly to the character and consistency of a rock, as an “earthy limestone,” meaning thereby that it is soft, friable, and non-crystalline.—In geography, the distinctive name for our planet, as associated with the Sun,

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Moon, and other bodies of the solar system; hence such phrases as the "Earth's mass," "Earth's orbit," "Earth's axis of rotation," and so forth.

Earth's Crust.—That external rind or shell of our planet which is accessible to human investigation; in contradistinction to the internal mass, of which we can know nothing by direct observation; the *Erd-rinde* of the German geologist.—See TEMPERATURE OF THE EARTH.

Earth of Bone.—A phosphate of lime, sometimes termed "bone phosphate," existing in bones after calcination.

Earth-Foam.—A fine, light, scaly variety of calcite or calc-spar, technically known as *aphrite*, which see.

Earthquake.—The familiar as well as technical term for any shaking or tremor of the earth's crust produced by subterranean agency. As the name implies, an earthquake consists of an agitation of some particular portion of the earth—the shock or convulsion being less or more violent, and extending over a less or greater area, according to the intensity of the motive power, and according to conditions of internal structure, with which we are but slenderly acquainted. The conditions accompanying earthquakes are by no means uniform, and though science has recorded a great many facts in connection with their occurrence, it is by no means in a position to enunciate any law either as regards their premonitory warnings, their intensity, their duration, or the direction of their movements. In some instances they are preceded by an unusual stillness of the air, by an unnatural agitation of the waters, and by hollow subterranean rumblings. In others, the shock comes on at once with or without noise—the earth is violently agitated by perpendicular lifts or heaves—rolls from side to side—or undulates with uneasy motion as if it were floating away from beneath the feet of the observer. The single shock of an earthquake seldom lasts more than a minute—often for a few seconds only; but they frequently follow each other after short intervals, and for a considerable length of time, and these paroxysms occur at certain periods more intensely than at others. Of course such movements of a solid, unelastic, and variously composed mass like the earth's crust—as if it were extensively cavernous or floated on a sea of molten matter—must be followed by fractures, fissures, and chasms; by upheavals and depressions; by elevations of the sea's bed into dry land, and the submergence of dry land beneath the waters of the ocean. Of all these we have abundant evidence and record within the historical period; and the further testimony, that these fissures often emit smoke and flame, and more frequently discharge fragments of stone and torrents of water.

From these and similar circumstances, as well as from their greater frequency in volcanic districts, there can be little doubt that earthquakes are intimately associated with volcanoes—in fact, are but varied expressions of the same primal agency. They produce modifications of the earth's crust chiefly by fracture, subsidence, and elevation. During their convulsions the level plain may be thrown into abrupt heights or rent by chasms and ravines; lakes may disappear and rivers change their courses; islands may be submerged or elevated and joined to the mainland; and maritime tracts may be sunk beneath the waters, or the adjacent sea-bed raised into dry land. Their *geological function* is therefore, like that of volcanoes, to diversify the surface of the globe, and to render irregular what aqueous agency is perpetually striving to render smooth and uniform.

Presuming on the uniformity of nature's operations, in subordination to the higher law of Creational Progress, the effects of earthquakes must have been similar in all time past, and to them, therefore, must be ascribed many of the fractures, dislocations, and contortions, so prevalent among the earlier rock-formations of the globe.—See SEISMOGRAPHY.

Earthquake-Waves.—The name given to those huge and sudden waves, or rather walls of water, which during earthquake convulsions are sometimes thrown with tremendous impetus upon the land. That rolled in upon the coasts of Portugal, during the great Lisbon earthquake in 1755, was estimated at 60 feet high.

Eboulément (Fr. *ébouler*, to tumble down).—A term adopted from the French for sudden rock-falls and earth-slips in mountainous regions.

Ebullition (Lat. *ebullitio*, a boiling or bubbling-up).—The boiling or bubbling-up of liquids after they have been heated to the *boiling-point*, which varies, of course, according to the altitude of the situation above the level of the sea. Many thermal springs are in a state of constant ebullition.—See BOILING POINT.

Ecculiomphalus (Gr., unrolled navel).—An obscure Lower Silurian shell, thin, curved or discoidal, with a few widely-separate whorls, slightly unsymmetrical and keeled. Usually placed among the Gasteropods, but by some regarded as a peculiar form of Pteropod.

Echinida, Echinoidea (Gr. *echinos*, the sea-urchin).—A well-known family of the Radiata, comprehending those marine animals commonly known by the name of *sea-eggs* or *sea-urchins*, and constituting, according to zoologists, the third order of the class *Echinodermata*, which see. The Echinida are found fossil in all formations, but are most abundant and beautifully preserved in the Chalk.

Echinite.—The general palæontological term for any fossil, sea-urchin, or cidaris, or portion thereof. *Echinites* are common in many formations, and wherever they occur give evidence of true marine conditions.

Echinobrissus (Gr. *echinos*, sea-urchin; *brissos*, sea-urchin).—An echinoderm of the Oolite and Chalk periods, so called from its closer resemblance to the existing sea-urchin in the form and arrangement of its spines.

Echinocyamus (Gr. *echinos*, and *kyamos*, bean).—A minute echinoderm of the Pleiocene period, so termed from the bean-shaped form of its crust or shell.

Echinodermata (Gr. *echinos*, and *derma*, the skin).—A numerous class, recent and fossil, of Radiata like the star-fish and sea-urchin—all less or more covered with a firm coriaceous or crustaceous integument, which in many instances is densely armed with spines. It embraces, according to recent zoological arrangements, the following orders:—

1. The *Crinoida*, or those species, almost exclusively fossil, which are fixed by a long jointed stalk, and have branching articulated tentacula extending from around the abdominal cavity, as in the common *encrinûre*.

2. The *Asterida* or *Stellerida*, comprising the free, flexible, and star-shaped species, which are destitute of stalk or peduncle, as the common star-fish (*asteria*). The asterida are recent as well as fossil in all formations.

3. *Echinida*, in which the body is inflexible, and composed of a solid articulated crust, the exterior surface of which is covered with movable calcareous spines, as in *echinus*. Recent as well as fossil in all formations.

4. The *Holothurida*, in which the axis of the body is placed horizontally,

and there is a soft coriaceous skin, seldom protected with spines, as in *holothuria*. Found in the glacial clays of the Clyde.

Or including fossil genera, we have the further subdivisions given in the preliminary tabulations, "ANIMAL SCHEME."

Echinospharites (Gr. *echinos*, and *sphaira*, a ball).—Literally "prickly ball;" a genus of echinoderms characterised by their small size and globular form, and restricted apparently to the Lower Silurian and Upper Cambrian periods.

Echinostachys (Gr. *echinos*, and *stachys*, a head of flowers).—A term applied to a singular fossil occurring in the New Red Sandstone; apparently a spike of inflorescence, beset on all sides with sessile, contiguous, sub-conical flowers or fruits. Supposed to be akin to the *Typhaceæ* or reed-maces.

Eclogite (Gr., select).—The name given to a coarse or fine grained mixture of green smeragdite with red garnet—a rock apparently of metamorphic origin. Some varieties take a good polish, and are coming into use as ornamental stones.

Eume de Mer, or **Meerschäum**.—Literally "foam of the sea;" a light white earthy silicate of magnesia, much esteemed for the bowls of tobacco-pipes.—See MEERSCHAUM.

Edaphodon (Gr.)—Literally "pavement-tooth;" a genus of Lower Tertiary fishes, founded chiefly on the jaws and dental apparatus, which resemble those of the existing *chimæra*, but yet differ so much as to have induced Professor Owen to erect the Edaphodonts (*Edaphodontidae*) into a separate family. Known also as *Passalodon* (peg-tooth), and *Pittacodon* (parrot-tooth).

Eddy (Sax. *ed*, water, and *ea*, backwards).—Any rotatory motion of water caused by the meeting of opposing currents. Eddies generally occur in estuaries where the tide meets the current of the river; and in seas where currents from different quarters meet, or where tidal currents are thrown back on themselves by opposing obstacles.—See WHIRLPOOL.

Edentata (Lat. *edentula*, toothless).—The sixth order of mammalia in Cuvier's arrangement, or quadrupeds agreeing in the unimportant character of being destitute of front or incisive teeth. It comprehends the *Edentata* proper—viz., ant-eaters, armadilloes, &c.—and the *Tardigrada* or sloths. Many of the huge Tertiary mammals of South America belong to the Edentate order.—See tabulations, "ANIMAL SCHEME."

Eddingtonite.—So called after its discoverer. A member of the Zeolite family, found implanted in minute crystals on Thomsonite in the Kilpatrick Hills, but very rare.

Edriophthalmous (Gr. *edraios*, sessile, and *ophthalmos*, the eye).—Applied to those crustaceans which, like the sandhopper and woodlouse, have immovable sessile eyes; in contradistinction to those which, like the crab and lobster, are stalk-eyed or *podophthalmous*. The group *Edriophthalma* comprises the amphipods, læmidopods, and isopods.—See tabulations, "ANIMAL SCHEME."

Effervescence (Lat. *effervesco*, I boil or bubble up).—The bubbling, hissing commotion which takes place in fluids when gas is generated and given off with rapidity. The effervescence of a Seidlitz powder, and of limestone under the action of muriatic acid, are familiar examples.

Efflorescence (Lat. *effloresco*, I put forth flowers).—Applied in mineralogy to those saline excrecences which cover certain minerals, like alum-

shale, sulphuret of iron, &c., when exposed to the action of the atmosphere—the air decomposing the saline crystals and abstracting their water of crystallisation. *Efflorescence* is caused by the removal of moisture, just as *deliquescence* is caused by the absorption of it.

Egg, Fossil.—The eggs of turtles occur in a sub-fossil, or rather in a petrified state in the shore-deposits of Ascension and other islands; those of snakes in fresh-water limestones of comparatively recent origin in Germany; those of birds (*dinornis* and *epiornis*) in the ancient river-silts of New Zealand and Madagascar; and those of unknown animals (birds, pterodactyles, or other reptiles) so early as the Oolitic formation.—Such remains are termed *Oolithes* and *Ovulites*, which see.

Egyptian Jasper, Egyptian Pebble.—"A variety of jasper occurring in roundish pieces, scattered over the surface of the desert between Cairo and the Red Sea. The surface of these masses is rough, and of a yellowish chestnut-brown colour, but internally the brown colour forms irregular concentric zones, between which are black spots and small black dendritic markings in a base of pale yellowish-brown colour" (Bristow). When cut and polished these jaspers are used as gem-stones.

Eifel.—A district on the Lower Rhine, celebrated in geology for its recent volcanic rocks, its brown-coal, and other Tertiary deposits, as well as for its highly fossiliferous Devonian and Silurian strata. The subject of papers in the geological journals by Lyell, Scrope, Horner, Hibbert, Hamilton, and others, as to its Tertiary phenomena; and the fertile field of research to Sandberger, Röemer, Von Dechen, and others, in its Palæozoic aspects.

Eisleben in Saxony; a locality well known for its finely-preserved *paleonisci*, and other fishes peculiar to the Carboniferous and Permian formations.

Elasolite (Gr. *elaion*, oil; *lithos*, stone).—A mineral of the Scapolite family, having a dull opalescent or fatty resinous lustre; the *Fettstein* or fatstone of Werner. Composition, 45 silica, 32 alumina, 15 soda, 5 potash, and traces of lime, magnesia, and iron peroxide.

Eläterite.—Known also as elastic "mineral pitch" and "mineral caoutchouc." A variety of bitumen possessing a certain degree of elasticity, and generally found in the crevices of Carboniferous limestone, as in Derbyshire and Fifeshire. On exposure to the atmosphere, elaterite gradually loses its elasticity, and becomes hard and brittle like asphalt. According to Johnston, it consists of about 85 carbon and 13 hydrogen, with traces of oxygen and nitrogen.

Elberseuth, near Bareuth, in the N.E. of Bavaria; celebrated for its Devonian strata, which abound in the shells of *Clymenia*—upwards of thirty species having been found there, and the greater number of them peculiar to the locality.

Electrum.—A term of the ancients for argentiferous gold-ore, and still applied to those varieties which contain more than 20 per cent of silver, and of a light brass or bronze-yellow colour.

Element.—A simple substance; one which chemistry cannot resolve into other component substances. Iron, for example, is a *simple* substance or elementary body; rust of iron, a *compound*, consisting of metallic iron and oxygen. Elements are spoken of as *proximate* or *intermediate*, and *ultimate*. Thus, limestone consists of lime and carbonic acid—these are its intermediate elements; but the lime is still further resolvable into calcium and oxygen, and the carbonic acid into carbon and oxygen—the calcium,

oxygen, and carbon being ultimate elements. Upwards of sixty elementary substances are known to the chemist, and of these all the countless combinations and matters in the mineral, vegetable, and animal world are composed.—See **CHEMISTRY**, and tabulations, "**CHEMICAL SCHEME**."

Elevating Causes.—Under this head are comprehended those agencies which refer to the operation of volcanoes, earthquakes, and gradually elevating forces. The operations of the volcano and earthquake are sudden and violent, and depend proximately on the presence of subterranean heat; gradual elevation, on the other hand, may arise from slow secular movements in the earth's crust, with the proximate causes of which geologists are yet unacquainted. The elevatory power of the volcano is seen partly in the upheaval of portions of the earth's crust into mountain chains and ridges, and partly in the accumulation round some centre of eruption of ejected lava, scorice, and other materials. The power of the earthquake is manifested both by subsidence and elevation—subsidence, as in the sinking of the Allah Bund at the mouth of the Indus in 1819; and elevation, as in the uprise of the coast of Chili in 1822. *Gradual elevation* manifests itself in such uprisings as those of the Scandinavian peninsula (to the extent of some three or four feet in a century), and appears to depend on movements in the earth's mass with which we are yet unacquainted.

Elie Ruby.—A variety of *pyrope* found in small garnet-like grains in the trap-tuff of Kinraig Point, near Elie, in Fifeshire.

Elutriation (Lat. *eluere*, to wash out or cleanse).—In chemistry and metallurgy, the process of washing by which the lighter earthy parts are separated from the heavier and metallic.

Elvan, Elvan Courses.—A Cornish name for a felspathic rock or porphyry occurring in dykes in the mining districts of that county.

Elytra (Gr. *elytron*, a sheath).—The hard crustaceous case or sheath which covers the membranous wings of coleopterous insects like the beetle; the wing-sheath. The elytra of beetles are found fossil from the Coal formation upwards.

Embouchure (Fr.).—The mouth of a river, or that part where it discharges itself into a lake or sea.

Emerald (Fr. *emeraude*; Ital. *emeraldo*; Lat. *smaragdus*).—One of the gems, and generally of a rich deep-green colour; the less brilliant and colourless varieties being known as *beryls*. The crystals occur in hexagonal prisms, rarely in columnar aggregates, and usually marked with vertical striae. The emerald is found either imbedded or in druses in some countries in the crystalline schists, but in the most celebrated modern locality (Muzo, in New Grenada), in a Secondary limestone abounding in ammonites. The finest specimens are brought from South America, but fair varieties have been found in Bavaria, India, and Siberia. According to Vauquelin, who, in analysing the emerald, first discovered the earth *glucina*, the purest specimens consist of 65 silica, 14 alumina, 13 glucina, 2.56 lime, and 3.50 oxide of chromium, to which last the gem was supposed to owe its fine green colour. According to the more recent researches of M. Levy, however, the colouring matter is considered to be a carburet of hydrogen, and of animal origin—a supposition to which the fossiliferous limestone of Muzo gives great support. The colour of the emerald can easily be destroyed by heat—a circumstance which does not occur in those gems that are coloured by oxide of chromium.—See **BERTL**.

Emergence, Emergent (Lat. *emergo*).—Rising out of that by which it was

covered; applied to islands and shores gradually rising from the ocean. Emergence and Subsidence are contradistinguishing terms.

Emery.—A massive, nearly opaque, greyish-black, or indigo-coloured variety of rhombohedral corundum, consisting of alumina, with a small percentage of silica and peroxide of iron. It occurs in Spain, the Greek Islands, and other localities, and derives its name from Cape *Emeri*, in the island of Naxos, from which most of the emery of commerce is derived, and where it occurs in large blocks in the soil, and sometimes in white marble. Triturated, sifted, and attached to paper or cloth, it forms the *emery-paper* and *emery-cloth* of the polisher.

Emmonite (after Professor Emmons of Massachusetts).—A snow-white variety of Strontianite, with an obscurely foliated structure, and a scaly appearance not unlike some varieties of gypsum. Consists of 82.7 carbonate of strontia and 12.5 carbonate of lime.

E'myde (Gr. *emys*, the fresh-water turtle).—Fresh-water turtles or mud-tortoises; a family of chelonian reptiles intermediate between the marine turtles and the land-tortoises. In form they are flatter than the land-tortoises; their toes are longer and webbed, but not so long as those of the marine turtles. Fossil species have been found in the Wealden and Tertiary strata.—See REPTILIA in preliminary tabulations, "ANIMAL SCHEME."

Enálisosáuria (Gr. *enalios*, marine, and *sauros*, lizard).—Literally sea-saurians; a group of fossil reptilians, including the aquatic forms—ichthyosaurus, pliosaurus, plesiosaurus, &c.—See SAURIANS.

Enámel.—In anatomy, the smooth, hard, glossy substance which in various forms constitutes the outer surface of the teeth; seen also on the scales of the fossil *ganoid* or enamelled-scale fishes.

Encéphalous (Gr. *en*, in, and *kephale*, the head).—Applied to those mollusca which, like the limpet and periwinkle, have a distinct head. The division *Encephala* comprehends the cephalopods, gasteropods, and pteropods—in other words, all the univalves.—See ACEPHALOUS.

Encriníte, Encrinítes (Gr. *krinon*, a lily).—The original and general term for the *Crinoidea* or lily-like echinoderms—an extensive and chiefly fossil class, characterised by their long many-jointed stalks, surmounted by lily-shaped bodies or receptacles, which were furnished with numerous finger-like rays capable of closing and expanding. The internal calcareous skeletons of the encrinítes (in scattered joints and fragments) are so abundant in some Carboniferous limestones as to compose the greater portion of the mass; hence the term *encrinal* or *encrinital limestone*. The minuter joints of the fingers and rays are usually termed *entrochi* or wheel-stones, and these, when abounding in certain limestones, confer on them the title *entrochal limestones*. The stalk having been perforated by a canal which kept the whole in vital union, the separated joints present a bead-like appearance; hence such familiar terms as "St Cuthbert's beads" and "wheel-stones" for the solid pieces; and "pulley-stones" and "screw-stones" for their hollow casts in limestones. It is usual, in a general way, to apply the term ENCRINITES to the genera having rounded stalks, and PENTACRINITES to those which are angular or pentangular.—See CRINOIDEA.

Endo (Gr. *endon*, within).—A common prefix in geology, as well as in other of the natural sciences; as *endogens*, plants increasing in growth from within; *endosiphonites*, a genus of fossil cephalopods having the siphuncle placed at the inner side of the whorls, &c.

END — ENT

Endocarp (Gr. *endon*, within, and *karpós*, fruit).—The stone or shell which, in fruits like the peach and cherry, encloses the embryo or kernel; the outer skin being the *epicarp*, and the fleshy edible substance the *sarcocarp*.

Endogens (Gr. *endon*, within; *ginomai*, I am formed).—That division of the vegetable kingdom—palms, grasses, rushes, and liliaceous plants—whose growth takes place from within, and not by external concentric layers as in the *Exogens*.—See MONOCOTYLEDONOUS, and tabulations, "VEGETABLE SCHEME."

Endogenites.—Fossil stems and fragments exhibiting the endogenous structure are so termed. "It is merely," says Brongniart, "a provisional assemblage of objects to be further examined."

Endosiphonites (Gr. *endon*, within).—A synonyme of Prof. Ansted's for the nautiloid shell *clymenia*, whose siphuncle is on the inner side of the whorls, therein differing from the ammonite, whose siphuncle is on the outer side or dorsal, and from the nautilus, in which it is central.

Engis, Engihoul.—The caverns of Engis and Engihoul—the former on the left bank, and the latter on the right bank, of the Meuse, about eight miles from Liège—have become celebrated in the question of man's antiquity, from their containing human remains imbedded in the same muds and breccias with those of mammoth, rhinoceros, cave-bear, reindeer, and other mammalia now extinct in Europe.

Enhydrous, Enhydrite (Gr. *en*, within, and *hydor*, water).—The name given to crystals and minerals containing water; the opposite of *anhydrous*.

Ensiform (Lat. *ensis*, sword, and *forma*, likeness).—Sword-shaped; straight, flat, and pointed, like the leaf of the iris; slender and more tapering forms being *lanceolate*; and those less or more recurved, *falciform*.

Entomolite (Gr. *entoma*, insects, and *lithos*, stone).—The general term for a fossil insect, or any part or fragment thereof.

Entomolithus Paradoxus (Gr. *entoma*, insects).—The term given by the earlier palæontologists to the trilobite, which was long confounded with insects in consequence of the segmented aspect of its body.

Entomology (Gr. *entoma*, insects, and *logos*, reasoning).—The science of insects; that branch of natural history that treats of the history and habits of insects. **Entomological**.—Pertaining to the science of insects.

Entomologist.—One devoted to the study of insects.

Entomophagous (Gr. *entoma*, insects, and *phago*, I devour).—Insect-eating; applied to those animals which chiefly subsist on insects. Same as *Insectivorous*, which see.

Entomotraca (Gr. *entomon*, insect, and *ostrakon*, shell).—Literally "shelled insect;" an extensive sub-class of crustacea, generally of small size, covered with a delicate skin, and usually protected by a broad shield or sort of bivalve shell. The branchiæ, when present, are attached to the feet, which, with the antennæ, are generally furnished with bristles that render them efficient organs of locomotion. Occur recent, and fossil in all formations, as *cypria*, *ceratiocaris*, *dithyrocaris*, &c.—See CRUSTACEA in preliminary tabulations.

Entrochi, Entrochites, and Trochites (Lat. *trochus*, a wheel).—Names given to the wheel-like joints of the encrinite, which are frequently scattered in great profusion through certain limestones; hence *entrochal marble*.—See SCREW-STONES, PULLEY-STONES, and ST CUTHBERT'S BEADS.

Envelope (Fr. *enveloppe*, to roll or wrap up).—A wrapper ; a cover ; any investing integument ; applied to superficial soils, clays, and gravels that mask or cover up the subjacent rocky strata.

Eocene (Gr. *eos*, the dawn, and *kainos*, recent).—A term introduced by Sir Charles Lyell to designate the Lower Tertiary strata, from the idea that the very small percentage of living testacea contained in these strata (according to Deshayes only $\frac{3}{4}$ per cent) indicates what may be regarded as the dawn or commencement of the existing or current condition of creation.—See TERTIARY SYSTEM.

Eólian (*Eolus*, the god of wind).—A term given by Nelson to loose material (sand and the like) drifted and arranged by the wind. As we have *aqueous* formations, so we may have *olian* or *sub-atrial*, which is the term most frequently employed.

Eosaurus (Gr. *eos*, dawn, and *sauros*).—A provisional genus of Enaliosaurians, occurring in the Nova Scotian Coal formation, and founded on some vertebræ which indicate, according to Mr Marsh their discoverer, "a reptile of large size, air-breathing, carnivorous, and aquatic, probably marine."

Eozoic (Gr. *eos*, dawn ; *zoe*, life).—A term recently introduced to express the oldest fossiliferous rocks, such as the Laurentian and Huronian of Canada, from their containing the first or earliest traces of life in the stratified systems. In this case *Eozoic* signifies older than the *Palæozoic*, and takes the place of *Azoic* and *Hypozoic*, which were formerly applied to such metamorphic strata.

Eozoön (Gr. *eos*, dawn, and *zoön*, animal).—A foraminiferal organism occurring in the Laurentian limestones of Canada, and so named by Principal Dawson from its position in the oldest stratified rocks yet known to geology. It is found in large sessile patches, after the manner of *Carpenteria* ; and though greatly mineralised, yet reveals to the microscope a structure resembling that of other foraminiferal forms. According to Drs Carpenter and Dawson, its affinities are towards the *Nummuline* group.

Epi (Gr. *epi*, upon).—A prefix adopted from the Greek, and having, as the case may be, the signification of *upon*, *over*, *outer*, *all through*, *besides*.

Epicarp (Gr. *epi*, and *karpós*, fruit).—The outer skin or husk of certain fruits ; the fleshy or edible portion being the *sarcocarp*, and the stone the *endocarp*.

Epidérmis (Gr. *epi*, and *derma*, the skin).—The outer skin, scarf-skin, or cuticle. Used in many branches of natural history, as in conchology, to the membranaceous horny cuticle that covers many shells ; in botany, to the membrane or outer bark that covers the stems of plants ; and in zoology, to the pellicle or scarf-skin that covers the true skin of animals. In general the epidermis can be peeled or rubbed off without injury to the underlying parts, and in many instances it peels and falls off with the increasing size and age of the plant or animal.

Epidote (Gr. *epi*, and *didomai*, I give or add to).—A member of the Garnet family, known also as *prismatic augite-spar*, *pistacite*, and *Arendhalite* ; and said to derive its name from its crystals, which always appear horizontal-prismatic, but are prolonged (or added to, *epididomai*) at the base of the prism in one direction. It is generally of a green or greyish colour, and occurs regularly crystallised in druses, or in granular, prismatic, and fibrous concretions. It is found in granite, diorite, and other crystalline rocks, and has many sub-species or varieties, as *zoisite*, *Thallite*,

Bucklandite, manganese-epidote, &c. It consists of 38 silica, 28 alumina, 14 lime, 17 peroxide of iron, and traces of manganese and magnesia.

Epigastric (Gr. *epi*, and *gaster*, the belly).—Belonging to the upper portion of the belly, or epigastric region.

Epimera (Gr. *epi*, and *meros*, a part or portion).—Those parts of the segment of an articulate animal which lie immediately above the joint of the limb; e.g., the *epimera* or side-segments of the lobster.

Epiornis.—A gigantic extinct bird of Madagascar.—See *ÆPIORNIS*.

Epiphyte (Gr. *epi*, and *phyton*, a plant or shoot).—A term for those plants which grow upon others, adhering to their bark, and rooting among the decaying portions of their epidermis. Generally restricted to those orchids that grow upon trees.

Epoch (Gr. *epoche*, a pause in the reckoning of time).—A term literally signifying a stop or fixed point of time from which succeeding years are numbered, but somewhat loosely used in geology as synonymous with age or era; as the "Silurian epoch," "epoch of gigantic reptilians."

Epsomite, Epsom Salt.—Sulphate of magnesia, consisting of 16.26 magnesia, 32.52 sulphuric acid, and 51.22 water. It occurs in botryoidal masses and capillary efflorescences in many mines, veins, and old coal-workings, and is a common ingredient in many mineral waters, like those of Epsom and Surrey. The greater portion of the Epsom salts of commerce, however, is manufactured from magnesian limestone.

Equator (Lat. *æquus*, equal).—The great circle on the earth's surface, every point of which is equally distant from the poles; such a circle cuts the globe into two equal parts or halves,—in other words, into *hemispheres*—viz., the Northern and Southern. When the sun is in the line of the equator, day and night are of equal duration, hence it is also termed the equinoctial line (*nox*, the night). **Equatorial**.—Belonging to, or in the region of the equator; as the "equatorial diameter" of the earth, the "equatorial current" of the Atlantic.

Equatorial Current.—That great current which manifests itself within the equatorial region of the Atlantic, Pacific, and Indian Oceans. In either ocean it has a decided westerly flow, is warmer by several degrees than the adjacent waters, and spreads over many degrees of latitude. It is influenced in its course and character partly by the trade-winds, and partly by the earth's rotation, and being unobstructed by islands is most decidedly felt in the Atlantic. In the Atlantic, as it strikes the South American shores it bifurcates into the Brazil and Guiana currents; in the Pacific, as it nears the Asiatic islands it separates into the Australian and Japan currents; and in the Indian Ocean, as it impinges on the African coast it is mainly deflected southward into the strong flow of the Mozambique current.

Equi (Lat. *æquus*, equal).—A common prefix in scientific terminology signifying equal or alike; as *equidistant*, equally distant; *equilateral* equal-sided; *equivaled*, having both valves alike.

Equidæ (Lat. *æquus*, a horse).—The Horse tribe; the family of solidungulous pachyderms, having only one apparent toe and a single hoof to each foot. It includes the horse, ass, zebra, &c.; and members of the family, differing slightly from the existing species, occur fossil in the middle and upper Tertiaries.

Equine (Lat. *æquus*, a horse).—Pertaining to the horse; belonging to the Horse family.

Equisetáceæ (Lat. *equus*, a horse, and *seta*, a hair or bristle; whence the English name *horsetail*).—An extensive order of marsh or boggy cryptogams or flowerless plants, well represented by the common "horsetail" of our bogs and ditches. They occur in every region from Lapland to the equator, but acquire their greatest magnitude and abundance in moist warm regions. They are also found fossil in all formations, the most gigantic specimens occurring in Carboniferous and Oolitic strata. The equisetums are readily distinguished by their erect hollow stems, which are striated and jointed, frequently with whorls of small attenuated leaves at the joints, and all less or more rough from the quantity of siliceous matter contained in their cuticle.

Equisetites (Lat. *equisetum*, the plant horsetail).—Fossil plants resembling the equisetum of our pools and marshes, and found in all formations from the Devonian upwards. In *equisetum* the stems are jointed, and surrounded by closely-fitting cylindrical sheaths, which are regularly tooth-letted, and which leave their impress on the stems; but the stems are not channelled throughout as in *Calamites*, for which they are apt to be mistaken.—See CALAMITES.

Equivalent.—A term frequently employed by geologists to designate strata or series of strata that have been formed contemporaneously in distant regions, or which, palæontologically speaking, are characterised by similar suites of fossils. Thus the "Keuper" of Germany, and the "Marnes Irisées" of France, are said to be the *equivalents* of the saliferous and gypsiferous sandstone and marls of Cheshire; the "Calcaire de Caen," or celebrated building-stone of Caen, the equivalent of our Great or Bath Oolite.—See Table of Contemporary or Equivalent Strata, in preliminary tabulations, "GEOLOGICAL SCHEME."

Era (Lat.).—In chronology, a fixed point of time, at which the computation of ensuing years is commenced, as the "Christian era." In geology the term is somewhat loosely employed, not only to denote the commencement of a new "system" or "formation," but the entire duration of that system or formation; as "the plants of the Carboniferous era," "the era of gigantic reptiles."

Erbium.—One of the rarer metals, of which very little is known. According to Mossander, the earth called *yttria* is a mixture of the oxides of three metals—*yttrium*, *erbium*, and *terbium*, which differ in the character of their salts, and some other particulars.

Eremacautsis (Gr. *ereme*, slow, and *kausis*, burning).—Slow-burning; decay. Liebig's term for that slow chemical change brought about by the action of the oxygen of the atmosphere on moist organic bodies, by which they are consumed or burnt without any sensible increase of temperature; e.g., the conversion of vegetable substances into humus.

E'rinite (*Erin*, the ancient name of Ireland).—The name given by Haidinger to a beautiful green arseniate of copper (59.5 protoxide of copper, 33.5 arsenic acid, 5 water, and 2 alumina), from its being found in the county of Limerick, in Ireland, where it occurs in mammillary crystalline groups. Also the name given by Thomson to a dull brownish-red variety of bole found in the amygdaloid of Antrim, and which consists of 47 silica, 18.5 alumina, 6.5 iron peroxide, 25 water, with traces of lime, salt, and magnesia.

Erismacanthus (Gr. *erisma*, subject of dispute, and *acantha*).—A provisional genus of fish-spines belonging to the Coal period, and so called from

their doubtful character—that is, whether a distinct genus or merely a species of *ctenacanthus*.

Erosion (Lat. *erosus*, gnawed or worn away).—The act of gradually wearing away; the state of being gradually worn away; e.g., “Valleys of erosion,” or those valleys which have been gradually cut out of the solid strata by the long-continued action of the river or rivers that flow through them. Most of the ravines and glens and river-channels in the British Islands are the result of *erosion*; for, whatever inequalities of surface may have originally directed the waters into their channels, all the subsequent deepening, and scooping out, and widening of the valleys, have been owing to the erosive force of running water laden with sand, gravel, and other triturating debris.

Erpetology (Gr. *erpetos*, reptile, and *logos*, reasoning).—That branch of natural science which treats of the structure, habits, and history of reptiles.

Erratic Block Group.—A synonyme of the Boulder Clay, so called from the large transported blocks which are thickly strewn through it.—See **PLEISTOCENE and DRIFT FORMATION**.

Erratic Blocks, Erratics.—A term frequently applied to those large water-worn and ice-borne blocks of stone (*boulders*) which are scattered so generally over the higher and middle latitudes of the northern hemisphere.

Eruption (Lat. *eructatio*).—A violent bursting forth of gaseous and liquid matter from any orifice or opening, as from the crater of a volcano or geyser.

Eruption (Lat. *e*, out of, and *ruptus*, burst forth).—A violent and forcible breaking out of enclosed matters; as the outburst of lava, ashes, mud, hot water, or steam from an opening in the earth's crust. **Erupted**.—Forcibly thrown forth, as stones, scorise, &c., from the crater of a volcano. **Eruptive**.—Applied to such igneous rocks as have evidently burst through the sedimentary strata, in contradistinction to those which have gently overfolded, and become *interstratified*.

Erythrine (Gr. *eruthros*, red).—The name given to cobalt-bloom, which occurs in small botryoidal masses and acicular diverging crystals, generally of a fine carmine or peach-red colour. As an arseniate of cobalt, its normal composition is 38.43 arsenic acid, 37.55 oxide of cobalt, and 24.02 water; but most specimens contain oxide of nickel and protoxide of iron.

Erythrite (Gr. *eruthros*, red).—A flesh-coloured variety of felspar, occurring in the amygdaloid of the Kilpatrick Hills, and so named by Thomson from its colour.

Escarpment (Fr. *escarper*, to cut steep).—The abrupt face or cliff of a ridge or hill-range.

Esairs or Escars.—The name given in Ireland to the elongated and often flat-topped mounds of post-glacial gravel which occur abundantly in the greater river-valleys of that country. Known as *Kaims* in Scotland and *Oaars* in Sweden, which see.

Esocidæ (Lat. *esox*, the pike).—The Pike family; represented by the well-known fresh-water fish of that name. The pikes are extremely voracious fishes, and for this purpose have their mouths abundantly armed with formidable teeth. Fossil species are said to occur from the Chalk period upwards.

Œsophagus or Œsophagus (Gr. *oio*, *oiso*, I carry, and *phago*, I eat).—The canal through which the food passes (or is carried) from the mouth to the stomach.

Estuary (Lat. *æstus*—*æstuo*, I boil—the tide; so called from the troubled boiling-up of the water-line, which marks its approach in river-mouths).—Estuaries are, properly speaking, tidal river-mouths, like those of the Thames, Severn, Solway, &c.; whose fauna and flora are mixed fresh-water and marine, or composed of such species as are peculiar to brackish waters. From these peculiarities, the geologist is enabled to determine that certain formations, such as the Wealden, have been deposited in estuaries, and not in fresh-water lakes, nor in the open ocean; and hence also the frequent use of such phraseology as “estuary limestones,” “estuary mud-stones,” and the like.

Étérian (Gr. *eterios*, annual).—The *Eterian Wind* of Europe is a northerly, or rather north-easterly wind, that prevails in early spring all over the continent. The word is applied, in Greek and Roman authors, to the periodical winds in the Mediterranean, from whatever quarter they blow.

Ethmoid (Gr. *ethmos*, a sieve, and *eidos*, like).—Sieve-like; perforated like a sieve. Generally applied to the bone of the nose, which is perforated like a sieve, for the passage of the olfactory nerves.

Ethnography (Gr. *ethnos*, a race, and *graphe*, a description).—An account or description of the origin, dispersion, connection, and characteristics of the various races of mankind. **Ethnology**.—The science of races, in all that relates to physical features, language, manners, religion, and other characteristics.

Etiolate (Fr. *etioler*).—In gardening, to grow up long-shanked and colourless; to blanch or make white, by concealment from the light. The inner leaves of lettuce and cabbages become *etiolated* by exclusion from the light; and the blanching or *etiolation* of celery is produced by earthing up, so as to exclude the actinic or colouring effect of the sun's light.

Échérote (Gr. *eu*, beautiful, and *chroa*, colour).—A rare arseniate of copper of a fine green colour; hence the name.

Éclase (Gr. *eu*, easily, and *klasis*, fracture).—The prismatic emerald of Mohs; a very rare mineral, found chiefly in Brazil and Peru, in transparent crystals of a pale bright green colour. It consists, according to Berzelius, of 43.22 silica, 30.56 alumina, 21.78 glucina, with the oxides of iron and tin. Its form is an oblique prism, variously modified. It is characterised by great brittleness (whence its name), the facility with which it becomes electric by heat, and the length of time it retains this property. These characters distinguish it from the true emerald and beryl; and its brittleness prevents its being employed as a gem.

Écidalite (Gr. *eu*, easily, and *dialyo*, I dissolve).—The rhombohedral almandine-spar of Mohs, one of the Haloid family, and so named from its easy solubility in acids. A rare mineral from Greenland, occurring in octahedral crystals of a soft reddish-lilac or hyacinthine colour, and containing zircon with silica and soda. It much resembles *almandine* or noble garnet, but is distinguished by its crystalline form, its lower specific gravity, inferior hardness, and action under the blow-pipe.

Eulephas (Gr. *eu*, well, and *elephas*).—Founding chiefly on their dentition, Dr Falconer proposes to divide the Elephants into three sub-generic groups—the *Stegodons*, the *Loxodons*, and the *Eulephants*—the latter term having reference to the typical elephants most familiarly known.

Enkairite (Gr. *eukairios*, convenient, well-situated).—A cupreous selenuret of copper, found disseminated in the calcareous rocks of Smoland in Sweden. Consists of 39 silver, 26 selenium, 23 copper, and 8 alumina.

Eunótia (Gr. *eu*, well, and *notos*, back).—A genus of Diatoms or microscopic plant-growths, having a siliceous simple or bivalve shield, flat below, and convex, and often richly dentated above; whence the name. Occurs in the mountain-meal of St Fiora, and in similar accumulations.

Euómphalus (Gr. *eu*, well, and *omphalos*, navel).—A whorled discoidal shell, ranging from the Lower Silurian to the Trias inclusive, but specially abundant in the Carboniferous limestone. In the euomphalus, which belongs to the family Turbinidæ and order Gasteropoda, the whorls are angular or coronated, the aperture polygonal, the umbilicus very large, and the shell frequently of gigantic dimensions.

Euósmite (Gr. *eu*, well, and *osmos*, odour).—The name given by Dr Glimbel to a fossil resin occurring in the lignites of the Upper Palatinate, Bavaria; and so termed from its strong, peculiar, and pleasant odour. The miners give it the name of "Kampferharz," its odour resembling that of camphor, and at the same time partaking of that of rosemary. It occurs either in semi-pulverulent masses of a brownish-yellow, or firm, and of the colour of cherry-gum. It is brittle, electric when rubbed, dissolves readily in alcohol or ether, and consists of 81.89 carbon, 11.73 hydrogen, and 6.38 oxygen. It is evidently the produce of the coniferous trees which constitute the bulk of the lignite.

Euphorbites.—Artis's term for the *Sigillaria pachyderma*, from its supposed affinity to the Euphorbias.

Eúphotide (Gr. *eu*, well, and *phos*, *photos*, light).—A crystalline rock consisting essentially of Labrador felspar and diallage, with subordinate intermixtures of hornblende or augite. So called from iridescent lustre or quality of reflecting light. The *Gabbro* of the Italian artists.

Éurite.—The whitestone or weiss-stein of Werner. A term of the French mineralogists for a variety of granite in which felspar predominates so as to give it a uniform white colour; generally small-grained, with a few crystals of quartz, and occasional scales of white silvery mica; sometimes porphyritic from the interspersation of larger crystals of felspar.

Eury nótus (Gr. *euros*, breadth, and *notos*, the back).—Literally "broad back;" a genus of Lepidoid fishes occurring in the Carboniferous formation, and differing from *Palæoniscus*, with which they were at one time united, in their high bream-like back, stronger crenulated scales, and generally larger size.

Eurypterite.—A convenient Anglicised term for any of the Eurypteris family, or for any undetermined portion or specimen thereof. Introduced to harmonise with Trilobite; hence we speak of the *trilobites* of the Silurian and the *eurypterites* of the Devonian epoch.

Eurypteris, Euryptéridæ (Gr. *euros*, breadth, and *pteron*, wing or fin).

—A genus and family of extinct crustaceans, ranging from the Upper Silurians to the Lower Coal-measures inclusive, and so termed in allusion to their broad oar-like swimming feet. The family embraces *eurypteris* proper, *pterygotus*, and others—all characterised by their long lobster-like forms, which consist (in the dorsal aspect) of an oblong-oval cephalothorax or carapace, with marginal or sub-central eyes; eleven abdominal or thoracic-abdominal segments, free and devoid of appendages; and a telson or tail-plate more or less elongated, and usually pointed. The carapace (in the oral or ventral aspect) is furnished with three pairs of five- or six-jointed members—the two first variously formed in the different genera (some furnished with spines, others with prehensile pincers), and

the posterior forming the broad swimming feet which give name to the family. The oral apparatus consists, as in the King-crab, of the serrated basal joints of the limbs, and is protected by a broad heart-shaped metastome or mouthpiece. In all the genera the exterior crust is ornamented with a peculiar scale-like sculpture, which becomes bolder and stronger on the free or exposed margins. The relations of the Eurypteridæ to other crustacean families are by no means well determined, and geologists must in the mean time rest satisfied with mere hints as to affinities with Copepoda, Pencilipoda, and other existing orders.—See PTERYGOTUS, CRUSTACEA, and tabulations, "ANIMAL SCHEME."

Eurythérion (Gr.)—Literally "broad beast;" a provisional genus of mammalia, apparently pachyderm and aquatic, from the Eocene and Miocene Tertiaries of Europe. Allied to *Halitherium*, which see.

Euthacanthus (Gr. *euthys*, straight, *acantha*, spine).—A genus of fishes (apparently placoid) occurring in the Lower Old Red of Forfarshire, ranging from seven to eighteen inches in length, and thus characterised by its discoverer, Mr Powrie:—Head small, rather compressed; body rather elongated; branchial arches numerous and exposed; tail heterocerical; fins membranous, preceded by conical spines—two dorsals, two pectorals, two ventrals, one anal; several pairs of intermediate dermal scutes; spines straight, and ridged longitudinally; scales smooth and minute.

Evaporation (Lat. *evaporo*, I send off in vapour).—The act of converting into vapour such liquids as water, either by natural or by artificial means, the former being termed "*spontaneous evaporation*." Heat is the grand evaporating agent in nature, and its effects are greatly facilitated by the removal of the vapour as soon as it is formed either by currents of wind, by absorption, or by other analogous means.—See VAPOUR.

Excavation (Lat. *ex*, out of, and *cavus*, hollow).—Any cavity or hollow, whether natural or artificial. Rocks are excavated naturally by the action of waves, by subterranean springs, by rivers, and other currents of water.

Excrement (Lat. *excrementum*).—That which is separated from the food after digestion, and ejected from the body of animals by the intestinal canal. *Excrementitious* or fecal matter is found abundantly in a fossil state, and known as *coprolite*, which see.

Excréscence (Lat. *ex*, out of, and *creasco*, I grow).—Any body or substance growing upon or out of another in an unusual manner; any preternatural growth of a substance, mineral or organic.

Excrétion (Lat. *excretus*, thrown out of, separated).—The act of separating or voiding excrementitious matter from the blood and food; also the substances excreted, as perspiration, fecal matter, &c.

Exfoliate (Lat. *ex*, from off, and *folium*, a leaf).—To separate or fall off in laminae or scales. *Exfoliation*, by weathering, is very perceptible in some varieties of greenstones which disintegrate, coating after coating (leaf after leaf), till the whole of the rock-face looks like a pile of concentric concretions in various stages of decay.

Exhalation (Lat. *exhalatio*, a breathing out of).—Any vapour or gaseous matter arising from substances or surfaces exposed to the atmosphere; as the "sulphurous exhalations" from a volcanic crater, the "poisonous exhalations" or miasm from a putrid bog or fen.

Exogenites.—Any fragment of fossil wood exhibiting the exogenous structure, and otherwise of unknown affinity, is so termed.

Exogens (Gr. *exo*, without, and *ginomai*, I am formed).—That division

of the vegetable kingdom whose growth takes place by external concentric layers of annual increment, like the beech, ash, elm, &c., in contradistinction to the *Endogens*, or those whose growth is not indicated by concentric layers. All the trees in cold climates, and most of those in hot latitudes, are *exogenous*, and are easily distinguished from the *endogenous* by the reticulated venation of their leaves.—See DICOTYLEDONOUS.

Exogyra (Gr. *exo*, outward, and *gyros*, a twist or turn).—The sub-generic term employed by Sowerby and others to designate the Chama-shaped species of *Gryphæa* having the umbones sub-spiral, and turned outwards or towards the posterior side. These shells are now usually included in the wider genus *Gryphæa*, though some still retain *gryphæa* and *exogyra* as sub-genera of the more typical genus *Ostrea* or oyster.

Exotic (Gr. *exotikos*, thence, from a strange country).—Applied to plants and animals, but chiefly to the former, that have been introduced into a country from other regions—that is, from without. Used in contradistinction to *indigenous*, or naturally belonging to a region, which see.

Expansion (Lat. *expansus*, spread out).—The increased bulk which bodies assume when heated. All substances, solid as well as liquid, when chemical change does not take place, expand by heat and contract by cold. Water presents an apparent exception to this rule, inasmuch as it attains its minimum volume at 40°, expands and is converted into steam above this temperature, and also expands as it falls below it, till converted at 32° into ice, a solid crystalline mass, which being lighter (or occupying a larger volume) floats on the surface. Clay also, from its losing its water of plasticity, shrinks or contracts by heat; but such contraction applies to the compound mass only—not to separate substances *per se*.

Explosion (Lat. *explosio*).—The sudden and violent expansion of any object, by which its constituent parts are burst asunder. *Explosion* differs from *expansion* inasmuch as it is always sudden and of momentary duration, whereas the latter is gradual, and more or less continuous. *Explosion* is also for the most part accompanied by chemical change; *expansion*, on the other hand, is mainly mechanical. *Explosion* has reference chiefly to gaseous substances; *expansion*, to solids and liquids.

Exsiccation (Lat. *ex*, out of, and *siccus*, dried up).—The drying up of solid bodies; the expulsion of moisture from their structure by heat, by pressure, or by any other means.

Extracrinus.—A sub-genus of *Pentacrinus*, and separated from that genus by Major Austin, in consequence of the more frequent bifurcation or subdivision of its tentacular arms. It occurs in tangled masses, forming beds of considerable extent in the Lower Lias of Dorset, Gloucestershire, and Yorkshire. "This Crinoid," says Lyell, "with its innumerable tentacular arms, appears to have been frequently attached to the drift-wood of the Liassic Sea, in the same manner as barnacles float about at the present day."

Exuvie (Lat., cast clothes).—In zoology this term is applied to the moulted or cast-off coverings of animals, such as the skin of the snake, the crust of the crab, &c.; but in geology it has a wider sense, and applies to all fossil animal matter or fragments of whatever description.

Eye-Stone.—The name given to those varieties of circle-agate which show, in the centre, a spot or spots more highly coloured than the concentric layers. Also given to varieties of stalactite which, when cut across, show a dark-coloured or hollow central portion, fancifully resembling an eye.

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Faboïdes (Lat. *faba*, a bean).—A term applied by Mr Bowerbank to certain bean-shaped leguminous seeds found in the London, or Lower Tertiary, clays of the Isle of Sheppey.

Face.—In crystallography, one of the planes which form the surface of a regular solid. A cube has six such "faces," or plane surfaces.

Facet (Fr. *facette*, a little face).—Applied to the small terminal faces of crystals and cut gems. Precious stones cut into numerous faces are said to be *facetted*, in contradistinction to being polished into rounded forms, or cut, as lapidaries term it, "*en cabochon*."

Facies (Lat.)—A convenient term in natural history, introduced to express any common resemblance or aspect among the rocks, plants, animals, or fossils of any area or epoch. Thus we speak of the "facies of the Carboniferous flora" as distinct from the floras of other epochs; and of the "facies of the Australian fauna" as distinguished from the animals of other regions by their common marsupial characteristics.

Factitious (Lat. *factus*, made).—Made or fashioned by art, in contradistinction to that formed by nature. We have thus factitious waters and factitious stones made to resemble the natural products.

Fæces, Fæcal (Lat. *fæx*, pl. *fæces*, excrement, worthless sediment).—The fossil fæces of fishes, saurians, &c., are known as *coprolites*; the hardened excrement of dogs and wolves, *album græcum*; that of mice, *album nigrum*. The preservation of *fæcal* matter is common in all the geological formations.

Fählore, Fählers (Ger. *fahl*, ash-coloured, and *erz*, ore).—The mineralogical term for "grey copper-ore," and the type of a family of minerals containing that important metal.—See tabulations, "*MINERAL SCHEME*."

Fählunite.—A sub-species of octahedral corundum, found in talcose rocks at Fahlun in Sweden, hence the name.—See *AUTOMALITE*.

Fahrenheit.—Fahrenheit's thermometer is that arrangement of the thermometrical scale in which the space between the freezing and the boiling points of water, under a medium pressure of the atmosphere, is divided into 180°; the freezing point being marked 32°, and the boiling 212°.—See *THERMOMETER*.

Falkes or Fakes.—A Scotch miner's term for fissile sandy shales, or shaly sandstones, as distinct from the dark bituminous shales known as "blaes" or "blaize."

Fairy-Stone.—A name given by the peasantry in the south of England to the flinty fossil sea-urchins found in the Chalk; also a term used by geologists for recent concretions of hardened clay or clay-ironstone occurring near the sources of certain chalybeate springs. In some districts the term "Fairy loaves" is that most frequently applied to the Chalk *ananchytes*.

Falcate, Falcated (Lat. *falx*, *falcis*, a reaping-hook).—Sickle-shaped, bent, or shaped like a reaping-hook.

Falciform (Lat. *falx*, a reaping-hook, and *forma*).—Shaped like a scythe or reaping-hook; e.g., certain bivalves and fish-spines.

Falling-Stones.—A familiar term for *aërolites* or meteoric stones, which see.

Faluns.—A French provincial term for the shelly Tertiary (Upper Miocene) strata of Touraine and the Loire, which resemble the "Crag" of Norfolk and Suffolk. Though generally composed of shelly sand and marl, in some districts they form a soft building-stone, chiefly composed of an aggregate of broken shells, bryozoa, corals, and echinoderms, united by a calcareous cement.

Family.—In natural history classifications this term denotes the group next in value and comprehensiveness above the *genus*. As species constitute a genus, so genera constitute a family. The word, however, is often used in a loose and general way, as equivalent to kind, tribe, or group.

Farewell Rock.—The familiar term in the South Welsh coal-field for the *Millstone Grit*, because on striking it the miner bids farewell to all workable seams of coal. In Wales, some beds of this grit possess the valuable property of resisting, for a long time, the action of the most intense heat, and are therefore used for the "hearths" of iron furnaces.

Farina (Lat. *far*, corn).—Meal or flour, obtained by grinding and sifting wheat or other corn. **Fossil Farina.**—A mealy-looking infusorial or microphytal earth—the *Berg-mahl* of the Swedes and Laplanders.

Farnham Beds.—A portion of the Upper Greensand, near Farnham in Surrey, which yields phosphate of lime in such abundance as to be largely used by agriculturists as a fertiliser. "It is doubtless of animal origin," says Lyell, "and partly coprolitic, derived from the excrement of fish and reptiles."—See *COPROLITES*.

Fascicular (Lat. *fasciculus*, a little bundle).—United or growing together in bundles or tufts, as the needle-shaped crystals of some of the zeolites, or the leaflets of the larch, pine, and other coniferæ.

Fasciculária (Lat. *fasciculus*, a cluster or little bundle).—A genus of polyzoa occurring in the Coralline Crag of Suffolk, and so named from its clustered or globular form. It belongs to the family of *Tubuliporida*.

Fasciolária (Lat. *fasciola*, a swathing band or stripe).—A genus of gasteropods belonging to the family *Muricida*, and so termed from the smooth band-like surface of their windings. They are thus distinguished from *Murex*, whose windings are rough with "varices" or wrinkle-like swellings, and from *Fusus* by their spirally-plaited columella. The existing species are found chiefly in warm and southern seas; the fossil occur in the Chalk and Upper Tertiaries.

Fassaita.—A variety or sub-species of angite, occurring in fine sharp crystals of high lustre, and dark or pistacio-green colour, in traps, altered limestones, and magnetic ores. It derives its name from *Fassathal*, in the Tyrol, where it is found in great perfection.

Fata Morgana.—The phenomenon of the *mirage* at sea. It arises from two currents of air of different density or temperature coming suddenly in contact; and as at sea the upper is generally the warmer and the lower the colder, the former becomes condensed at the place of contact, and forms, as it were, a mirror for the objects which are in the lower current, so that their images are inversely reflected. As the surface of separation is not level throughout, various refractions and distortions result, which often impart to the whole a singular and fantastic appearance. On land, where the warmer current of air is on the surface of the ground, the aerial mirror

is formed beneath the eye of the observer, by which the same phenomenon is produced that results from the reflection of objects on the surface of the water. The name is said to be of Breton origin—*mor*, sea, and *gana*, fine lady—the fairy mermaid of our popular legends.—See MIRAGE.

Fault.—The term for any fissure accompanied by a displacement of the strata on either side. On one side the strata may be *thrown down* many fathoms, on the other, *thrown up*; and at the same time may be altered in their dip or inclination. Strata so fissured and displaced are said to be "*faulted*." *Slip, slide, shift, heave, hitch, throw, trouble*, and the like, are familiar and synonymous terms.—See THROW.

Fauna (Lat. rural deities).—A convenient term for the animals of any given epoch or area; e.g., the "fauna of South America," the "fauna of the Permian Era." As the Animals of an area or epoch constitute its FAUNA, so the plants constitute its FLORA.

Favosites (Lat. *favus*, a honeycomb).—A genus of sessile-spreading corals common to the Silurian, Devonian, and Carboniferous systems; and so called from the regular polygonal arrangement of their pore-cells.

Favulária (Lat. *favosus*, honeycombed).—A genus of Coal-measure stems, so called from the aspect of their leaf-scars, which resemble in closeness and regularity the arrangement of a honeycomb. The *Favularia* have furrowed stems, with square-shaped leaf-scars on the ridges—the scars being of a breadth with the ridges. The stems seem to have been clothed with a densely imbricated foliage, the leaves running in parallel rows, which were separated by narrow intermediate furrows.

Felidæ (Lat. *felis*, a cat).—The Cat kind; a family of carnivorous mammalia, characterised, like the lion, tiger, cat, &c., by their short powerful jaws, retractile claws, and the peculiar adaptation of their teeth for cutting (trenchant). Geologically, the Felidæ are of recent origin, their remains not occurring prior to the Pleistocene cave-period; e.g., the *Machairodus*.—See tabulations, "ANIMAL SCHEME."

Felspar (Ger. *feldspath*, rock-spar).—An important rock-constituent or simple mineral, consisting essentially of silica and alumina, with potash or soda, and traces of lime, magnesia, and peroxide of iron. It is the representative of a family—the *Felspar family*—whose species enter largely into the composition of all igneous rocks—granite, porphyry, greenstone, and trachyte. It occurs crystallised, disseminated, massive, or amorphous; is colourless, but usually of shades of greyish-white, reddish, yellow, or green; when crystallised, breaks into rhomboidal fragments, whose flat surfaces have a peculiar pearly-vitreous or resino-vitreous lustre; and its crystals have a hardness about 6, with a specific gravity varying from 2.5 to 2.75. In ordinary granite it is readily distinguished from the quartz, with which it is associated, by its flat lustrous fracture, and by its being scratched by the knife while the quartz resists it. The more abundant and better-known species are *Orthoclase* or potash-felspar, with its varieties *adularia*, common felspar, glassy-felspar, and *felsstone* or compact felspar; *Albite* or soda-felspar, known also as *Clevelandite*; *Labradorite*; *Oligoclase*; and *Amorphous felspar*, with its varieties *obsidian*, *pumice*, *pearlstone*, and *pitchstone*—all of which are noticed under their respective names. Mineralogically and geologically, the felspars are most important minerals, and industrially they have also their value—some, as *adularia*, being used by the lapidary; others, as common felspar, for enamels, artificial teeth, and the like; and the decomposable varieties yielding in

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nature the finest *kaolin*, or china clay, to the potter. Mineralogically, the interchanges of soda, potash, and lime in the several varieties, are curious and instructive; and geologically, the fact that potash abounds in the more siliceous felspars of the older Plutonic rocks, whereas soda and lime prevail in the less siliceous or volcanic, is not without its significance and value. The following exhibits their range of composition, and consequently accounts for their varying external or physical characteristics:—

	Silica.	Alumina.	Potash.	Soda.	Lime.	Iron.
Orthoclase...	64—70	15—20	7—14	1—4	1—3	1—2
Felstone ...	71—80	11—15	4—7	...	0—1	1—2
Albite	67—71	14—20	1—4	7—11	1—3	0—1
Labradorite.	48—55	26—30	0—1	1—4	9—12	1—3
Anorthite ...	42—46	32—37	0—1	0—1	10—18	0—1
Oligoclase ...	60—64	18—24	1—3	2—10	2—5	0—1
Obsidian ...	72—84	4—11	6—10	3—5	1—4	1—3
Pumice	70—77	12—18	0—4	0—4	2—4	1—4
Pitchstone...	66—76	8—14	...	2—6	2—5	1—4

Felspathic.—Of the nature of felspar; containing felspar. Any mineral or rock in which felspar greatly predominates is said to be felspathic; as, “felspathic claystone,” “felspathic greenstone,” &c.

Felstone.—The term now generally employed by geologists to designate *compact felspar* which occurs in amorphous rock-masses, and used in contradistinction to *felspar* proper which occurs in more or less definite crystallised forms. The term *Felsite* was at one time employed for the same purpose, but is now all but obsolete.

Fen (Sax.)—In geography, low land overflowed, or covered wholly or partially with water, but producing reeds, sedges, coarse grasses, and other aquatic plants; low marshy tracts like the *fens* of Lincolnshire, Kent, and Cambridgeshire.

Fenestella (Lat., a little window).—An extensive genus of polyzoans, resembling the *retepora* or *Austra* of existing shores, and found in all the Palæozoic strata, from the Silurian upwards. In *fenestella* the cells are very small, indistinct externally, with minute prominent openings; and the polypary or cœnocium composed of branches which unite by growth and form a cup.

Fermentation (Lat. *fermentatio*).—The spontaneous decomposition of the proximate principles of organic bodies, under the joint influence of *warmth*, *air*, and *moisture*, and the reunion of their elements forming new compounds; e.g., the conversion of the expressed juice of the grape into wine, or a solution of malt into alcohol or spirit. The simplest case of fermentation is that of *must*, or the expressed juice of the grape, which, when exposed, either in close or open vessels, to a temperature of about 70°, soon begins to give off carbonic acid, and to become turbid and frothy; after a time a scum collects upon the surface, and a sediment is deposited; the liquor, which had grown warm, gradually cools and clears, loses its sweet taste, and is converted into *wine*. This is the “vinous fermentation;” but if the wine be further exposed to air, and a due temperature, a second fermentation ensues, which is called the “acetous fermentation,” and which terminates in the production of *vinegar* or *acetic acid*. In other words, the oxygen of the air converts the hydrogen of the alcohol—alcohol consisting theoretically of carbon, water, and hydrogen—into water, and leaves in the acetic acid an indestructible or permanent residue of carbon and water

only. *Fermentation*, or *putrefaction*, thus differs from *eremacausis*, or *decay*, in being limited to changes occurring in and beneath the surface of water, the effect being a mere transposition of elements or a metamorphosis of the organic body. *Eremacausis*, on the other hand, refers to the decomposition of moist organic matter, when freely exposed to the air, by the oxygen of which it is gradually burned and destroyed, without any sensible elevation of temperature. In the economy of nature as well as in the arts of life, fermentation or putrefaction is an agency of the highest interest and importance. "Like the labours of a scavenger," says Dr Cooley, from whom we abridge, "it speedily removes from the surface of our globe those matters which would otherwise remain for some time without undergoing decomposition. It either dissipates in air, or reduces to more fixed and useful forms of matter, those organic substances which by their presence would prove noxious, or at all events useless, to the animal and vegetable kingdoms. It is the great power that cleans the Augean stable of nature, at the same time that it provides some of the most esteemed articles of utility and luxury (the fermented liquors, &c.) for the wellbeing and enjoyment of man."

Ferricalcite (Lat. *ferrum*, iron, *calx*, *calcis*, lime).—A term occasionally applied to those varieties of limestone which contain a notable percentage of iron, from seven per cent and upwards.

Ferriferous (Lat. *ferrum*, and *fero*, I yield).—Applied to veins, strata, and other matrices that yield or contain iron.

Ferruginous (Lat. *ferrum*, iron).—Impregnated or coated with oxide of iron; rusty-looking.

Ferruginous Quartz, or Iron Flint.—A variety of quartz occurring in various formations; containing from 4 to 7 per cent of iron as an admixture, and forming the transition into jasper. Very hard.

Fettstein (Ger., fat-stone).—Same as *elæolite* (oil-stone) or nepheline. One of the Scapolite family, so called from its fatty or resinous lustre. Consists of silica 45, alumina 32, soda 15, and potash 5, with traces of lime, magnesia, iron, and water.

Fibrolite.—A term occasionally applied to the fine fibrous varieties of Andalusite. They consist of from 38 to 46 silica, 50 to 58 alumina; and .75 to 2.5 iron peroxide; and are known also by the name of *Bucholzite*.—See **ANDALUSITE**.

Fibrous (Lat. *fibra*, a thread or fibre).—Applied in geology and mineralogy to rock and mineral textures which consist of or resemble fibres, as amianthus or asbestos.

Fichtelite.—A fossil resin occurring chiefly in the form of yellowish transparent scales between the annual rings of growth of a species of pine which have separated from each other in the process of decay. So named from being found in the turf-beds of the Fichtelgebirge, North Bavaria.

Ficoidites (fig-like).—The generic term used by Artis, in his 'Antediluvian Phytology,' for the *Stigmara ficoides*, which see.

Figuline (Lat. *figulus*, a potter, from *fungo*, I fashion).—A term occasionally applied by mineralogists to potter's clay.—See **CLAY**.

Figure-Stone.—A variety of talc-mica or steatite; known also as *Agalmatholite*. Its usual colour is white or red, or both colours intermingled in bands and patches. The finest are brought from China, where it is cut into various figures, pagodas, &c.; hence the names *figure-stone*, *pagodite*, and the like.

Files.—A familiar term among the peasantry of the south of England for the striated and tuberculated spines of *Cidaris*.

Filices (Lat. *filix*, a fern).—In botany, the Fern tribe—the *Filicales* or Filical Alliance of Lindley.—See tabulations, "VEGETABLE SCHEME."

Filicites (Lat. *filix*, a fern).—Scolothem's generic term for the fern-like plants now called *neuropteris* and *pecopteris*; used also as a general term for any fossil fern or filicoid plant.

Filicoid (Lat. *filix*, fern, and *eidos*, likeness).—Applied to plants, recent or fossil, which resemble or partake of the nature of the fern tribe.

Filiform (Lat. *filum*, a thread).—Thread-like; slender as a thread.

Filtration (Lat. *filtrum*, an instrument for straining liquids).—The separation of liquids from substances mechanically suspended in them, by passing them through the pores of media sufficiently fine to keep back the particles of solid matter. Gravel, sand, sandstone, and other porous strata, are the great filtering media in nature.

Florite.—Pearl-sinter; a variety of siliceous sinter found incrusting volcanic tufa at Santa Fiora in Tuscany, whence the name. It is not uncommon in the vicinity of hot springs and volcanoes, and consists chiefly of silex, with a little alumina, iron-peroxide, and water.

Fire-Clay.—Any clay capable of resisting a great heat without slagging or vitrifying. This property arises from the absence of any alkaline earth to act as a flux. Fire-clays abound in the Coal-measures of Great Britain, and are largely employed in the manufacture of furnace and grate bricks, retorts, chimney-flues, and the like. The celebrated Stourbridge clay (Worcestershire) is said to consist of about 64 silica, 24 alumina, and 2.0 oxide of iron—the rest being water and traces of carbonaceous matter.

Fire-Damp.—A miner's term for light carburetted hydrogen, which, when diffused in the atmosphere of the coal-workings to the amount of one-thirteenth by volume, becomes explosive. The most explosive mixture is said to be *seven* volumes of air to *one* of fire-damp. When the proportions vary considerably either above or below that of seven to one, the mixture is not explosive.—See AFTER-DAMP and CHOKE-DAMP.

Fire-Opal, or Girasol.—A fine lustrous variety of opal, which see.

Fire-Stone.—Any stone that stands heat without injury; generally applied to certain Cretaceous and Oolitic sandstones employed in the construction of glass-furnaces. In geological classification, a calcareo-arenaceous member of the Upper Greensand, so called from its yielding stone of this description.

Fissile (Lat. *fissilis*).—Capable of being split; applied to rocks which, like clay-slate, can be split or divided in the direction of the grain or cleavage. **Fissility.**—The quality or characteristic of admitting to be split in thin leaves or lamina.

Fissiparous (Lat. *fissus*, split or divided, and *pario*, I produce).—Generation, or rather multiplication, by the self-division of the individual into two or more parts, each of which becomes a perfect creature similar to its parent-original. Generation may thus be *fissiparous* (by division), *geminiparous* (by buds), *oviparous* (by eggs), or *viviparous* (by living young). **Fissiparism** is confined, of course, to the lower vegetable and animal forms.

Fissure (Lat. *fissus*, split asunder).—A crack, rent, or open crevice in rocks; strata or rock-masses so rent are said to be *fissured*.

Fistulous, Fistular (Lat. *fistula*, a pipe).—Hollow like a pipe; tube-like. Applied to the stems of grasses, umbelliferous plants like the hemlock, &c.

Fixed Air.—A name formerly given by chemists to carbonic acid gas, from its being the air or gas fixed, as it were, in lime, magnesia, and the alkalies.

Flabellaria (Lat. *flabellum*, a fan).—A provisional genus intended to embrace all those broad, flabelliform, palm-like leaves which occur particularly in the Coal formation and Tertiary lignites.

Flabelliform (Lat. *flabellum*, a fan, and *forma*, likeness).—Fan-shaped ; applied to the broad spreading leaves of certain palms,—such leaves being found in many lignites as well as in the older Coal formations.

Flagstone.—A quarryman's term for any fissile sandstone which "beds," or splits up into flags, like the Arbroath and Caithness paving-stone. **Flaggy.**—Applied to the laminar strata capable of being split up.

Flamé Coal.—A peculiar variety of bituminous coal occurring abundantly in the Belgian coal-fields. It burns rapidly with much flame and smoke, not giving out an intense heat, and having a somewhat disagreeable odour. It resembles some of the seams found at Swansea in Wales.—See COAL FAMILY.

Flexible Sandstone.—A fissile variety of sandstone, thin slabs of which have a certain amount of flexibility. This property, in some instances, arises from the dissemination of minute scales of mica, and in others from a peculiar arrangement of the particles, which stand apart as if some ingredient had been removed by percolation.

Flint Implements.—The general term for spear-heads, arrow-heads, knife-like flakes, and other implements, whether for war, the chase, or domestic purposes, which are formed of flint, and are used or have been used by rude tribes unacquainted with the use of the metals. In Europe these implements are found abundantly in Post-Tertiary or Upper Pleistocene drifts and caverns, and belong to what is termed the "stone age" of archaeology ; and in some instances, as at Abbeville (which see), seem to have been imbedded contemporaneously with the bones of Mammoth, Irish Elk, and other extinct mammalia—thus bespeaking a vast antiquity for the people who fashioned them.

Flints (Sax).—The familiar as well as technical term for those siliceous nodules and concretions which occur so abundantly in the white chalk of England, in many limestones, and other calcareous strata. *Flints* are composed almost entirely of silex, with traces of iron, clay, and lime ; and where lime is present in any notable proportion, or when limestones become so siliceous as to be incapable of conversion into quicklime, the admixture is known as *Chert*. In the Chalk formation, flints are usually aggregated round some nucleus of sponge, shell, coral, or other organism ; and there is little difficulty in conceiving the silex to have been originally in solution in the waters of deposit, and subsequently segregated by some chemical process into layers and nodules as we now behold it. Being so frequently collected round spongiform organisms, it has been ingeniously surmised by Dr Bowerbank, "that the geological office of the Sponges in creation is that of inducing the deposit of siliceous matter held in solution in the ocean, just as the corals assist in the consolidation of the calcareous matter." Economically, flint is of considerable importance, being largely used (when calcined and ground) in the manufacture of china, porcelain, flint-glass, and the like. It is also employed, in absence of other material, as a building-stone ; and before the invention of percussion-caps and lucifer-matches, was in universal use for gun-flints and fire-production.

Float-Stone (Ger. *Schwimmstein*).—A variety of earthy silica, of a coarse porous aspect, soft and often friable, and of a yellow or greyish-white colour. Being porous, it swims on water till saturated; hence the name, *float-stone* or *spongiform quartz*. According to Ehrenberg it consists chiefly of the siliceous coverings of infusoria, and is thus closely related to *tripoli*, *polishing-slate*, and other earthy silicas. An analysis by Schaffgotsch gives 85.9 silica, 0.7 alumina, 9.1 carbonate of lime, and 3.3 water.

Flocculent (Lat. *floccus*, a lock of wool).—Applied to solutions or mechanical suspensions of impalpable mineral matter—the particles aggregating in light cloudy “flocks” during the act of deposition.

Flookan or **Flucan**.—A miner’s term for a soft clayey substance occasionally found in cross-courses and slides; a cross-course or transverse vein composed of clay. A *cross-flookan* is a slide or fissure filled with clay which runs across a lode and heaves it.

Flora (Lat., the goddess of flowers).—A convenient term for the vegetation of any given epoch or area—as “the flora of the Coal-measures”—“the flora of South America.” As the plants of a country or epoch constitute its *FLORA*, so the animals constitute its *FAUNA*.

Flos-Ferri (literally, flower-of-iron).—A fine radiated or corralloid variety of arragonite, common in the iron mines of Styria, and also in some limestone beds. Known also as *Needle-spar*; and differs from *Satin-spar*, which is a fine fibrous silky variety of the same mineral.—See *ARRAGONITE*.

Flötz (Ger., a layer).—A term applied by Werner to the Secondary strata, because they were *flötz*, or flat-lying, compared with the Primary and Transition rocks.

Fluor-Spar (Lat. *fluere*, to flow; so called from being used as a flux).—Fluate of lime, or fluoride of calcium, consisting of 67.75 lime, and 33.25 fluoric acid. It occurs chiefly in veins either crystallised in cubes, foliated, in granular crystalline masses, or compact and earthy. Its colours are various, the more common being violet-blue, honey-yellow, green, and purplish-blue passing into red. Beautiful crystals are found in the lead mines of Alston Moor and Derbyshire, and the concretionary crystalline masses of Castleton in Derbyshire (known as *Blue-John* or *Derbyshire spar*) are wrought into various ornamental articles.

Fluviatile (Lat. *fluvius*, a running river).—Belonging to a river; produced by river action; growing or living in fresh-water rivers.

Fluvio-Marine (Lat. *fluvius*, a river, and *mare*, the sea).—Applied to stratified deposits which seem to own a mixed river and sea origin; in other words, to deposits brought into the sea by river-currents, loaded with the detritus of the land: hence the occurrence in the same beds of terrestrial, fresh-water, and marine remains.

Flux (Lat. *fluere*, to flow).—In chemistry and metallurgy, any substance added to facilitate the fusion of metals or minerals. Alkaline fluxes are generally employed; they render the earthy mixture fusible by converting it into glass. Salts of potash and soda, lime, borax, and the like, are well-known fluxes.—In hydrography, the flow of the tidal wave—the Flux being the rise, the Reflux the ebb of the tide.

Flysch.—A provincial Swiss term for a series of Tertiary strata consisting of dark-coloured slates, marls, and fucoidal sandstones immediately overlying the nummulitic limestone. According to Lyell, the *flysch* occupies a middle place in the Eocene or older Tertiaries.

Föhn.—The name given in Switzerland to the hot southerly winds of

summer (the sirocco), which, arising from the northern tracts of Africa, cross the Mediterranean, and impinge on the snow-clad Alps, thereby annually causing a rapid diminution of the lower glaciers. "Were the desert tracts of Africa again covered, as they once were, by the ocean," says Prof. Phillips, "the wind would lose its excessive dissolving power, snows would gather on the Alps above, and glaciers extend below to levels and distances now quite unattainable without some great physical change."

Foliated (Lat. *folium*, a leaf).—Resembling a leaf; composed of thin leaf-like layers. Thus certain shells are said to be *foliated*, when their surfaces are covered with leaf-like projections, as the rose-bush murex; the substance of a shell is also said to be foliated when composed of thin flat layers overlapping each other, as in the oyster; and we speak of *foliated gypsum*, when the texture is scaly or leafy, and not granular or compact.

Foliation (Lat. *folium*, a leaf).—In botany, the manner in which the young leaves of plants are arranged in the leaf-bud; synonymous with *vernation*. In geology, the laminæ or plates into which gneiss, mica-schist, and other crystalline rocks are divided. "*Cleavage*," says Mr Darwin, "may be applied to those divisional planes which render a rock fissile, although it may appear to the eye quite or nearly homogenous; *foliation* may be used for those alternating layers or plates of different mineralogical nature, of which gneiss and other metamorphic schists are composed." The subject of foliation has given rise to a great deal of unsatisfactory speculation and hypothesis, some associating the phenomenon with cleavage, contending that the planes of both are generally coincident, and attempting to account for both by the same metamorphic process; while others maintain that foliation is identical with the lines of bedding, and is a structure conferred on stratified rocks by their original deposition. While leaning to the latter hypothesis, Sir Charles Lyell, at the same time, "fully admits that the alternate layers of quartz, or of mica and quartz, or of felspar, or of mica and felspar, or of carbonate of lime, are more distinct in certain metamorphic rocks than the ingredients composing alternate layers in most sedimentary deposits, so that similar particles must be supposed to have exerted a molecular attraction for each other, and to have congregated together in layers more distinct in mineral composition than before they were crystallised."

Foralites (Lat. *foro*, I bore).—Applied to certain tube-like markings which occur in sandstones and other strata, and which seem to have been the burrows of *annelids* having the habits of the common lob-worm.

Foraminifera (Lat. *foramen*, an orifice, and *fero*, I bear).—The name given by D'Orbigny to a group of minute, many-chambered shells, or rather many-celled organisms—the calcareous cells (*loculi*) of which are pierced, like a sieve, with numerous pores or *foramina*. The Foraminifera were supposed by D'Orbigny to be cephalopods, but more recent observation (Dujardin) has shown that they are not mollusca, but compound *Protozoa*, whose cellular aggregation produces the many-chambered aspect in question—the numerous pores being for the protrusion of their delicate filaments. Physiologically speaking, and according to Owen, a Foraminifera may be regarded either as a series of individuals organically united; or as a simple aggregate-being, compounded according to the law of vegetative repetition. They occur in rocks of all formations, from the Laurentian upwards—their microscopic remains constituting the greater bulk of the Chalk and Tertiary limestones.—See RHIZOPODA and POLYTHALAMIA.

Forest-Bed.—The name given by English geologists to a stratum which underlies the Glacial Drift at Cromer in Norfolk, because it imbeds abundant stumps, trunks, and branches of trees. This bed can be traced for miles between high and low water mark, and contains numerous erect stumps and prostrate trunks of trees, such as the Scotch fir, spruce, yew, alder, oak, &c., together with remains of elephant, rhinoceros, hippopotamus, horse, pig, and other mammals. The whole, in fact, exhibits both the flora and fauna of a forest of the preglacial era.

Forest Marble.—An argillaceous laminated shelly limestone, alternating with clays and calcareous sandstones, and forming one of the upper portions of the Lower Oolite. It derives its name from Whichwood Forest in Oxfordshire, where the finer bands are quarried as a marble.—See OOLITE.

Formation.—"The term *formation*," says Lyell, "expresses in geology any assemblage of rocks which have some character in common, whether of origin, age, or composition. Thus, we speak of stratified and unstratified, fresh-water and marine, aqueous and volcanic, ancient and modern, metalliferous and non-metalliferous formations." In this wide sense, however, the word is often loosely and inaccurately used; and when speaking of the stratified rocks, it is better to restrict the term to such an assemblage of strata as are connected by mineral composition, by unbroken succession in point of time, and by continuity of fossil species. In this sense we have such assemblages as the "Chalk formation," "Coal formation," &c., whose members, though differing in minor particulars, have evidently been *formed* or deposited under a continuance of similar conditions.

Fossil (Lat. *fossus*, dug up).—Literally anything dug out of the earth; hence the earlier geologists spoke of *native fossils* or minerals, and *extraneous fossils* or the bodies of plants and animals accidentally buried in the earth. The term is now generally restricted to "organic remains," or the remains of plants and animals imbedded in the earth's crust, and more or less altered in structure and composition by mechanical and chemical agencies. When these remains are only partially petrified, and occur in superficial or recent deposits, the term *sub-fossil* is employed.

Fossiliferous (Lat. *fossilis*, and *fero*, I bear).—Applied to rocks and rock-systems containing organic remains, in contradistinction to *non-fossiliferous*, or those which contain no such relics.

Fossilisation, Fossilised, &c.—The conversion of vegetable and animal remains into fossils, by impregnation with mineral or metallic matter.—See PETRIFICATION.

Fossil-Paper, Fossil-Wool, Fossil-Flax, Fossil-Cork, &c.—Familiar terms applied to certain varieties of amianthus, according as these appear in thin *papery* flakes, in *flax-like* fibres, in loose *woolly* flocs, or in tough *cork-like* fragments.—See ASBESTOS.

Fracture (Lat. *fractus*, broken).—When a mineral breaks up into determinate forms with smooth regular surfaces, such surfaces are said to constitute its *cleavage*; but when a rock or mineral breaks up irregularly under a blow of the hammer, the appearance of the fresh surface so exposed is termed its *fracture*. Thus the fracture is said to be *even* when it forms a face or plane of some extent; *uneven*, when the surface is rough and unequal; *conchoidal*, or shell-like, when concave on one side and convex on the other; *splintery*, when the surface presents the appearance of numerous thin-edged scales; and *hackly*, when covered with numerous sharp points or inequalities.

Fragmentary (Lat. *fragmentum*, a chip or portion broken off, from *frango*, I break).—Applied in geology to rock-masses composed of the fragments or debris of other rocks; rocks not homogeneous in texture; nearly synonymous with breccias or breccio-conglomerates, which see.

Frangibility.—In geology, the degree of facility with which a rock yields to the hammer.

Franklinite (after Benjamin Franklin).—An ore of iron occurring in grains or in granular masses of an iron-black colour and metallic lustre, and found in veins, often of great thickness, as those of New Jersey in the United States. It consists of from 56 to 66 peroxide of iron, the remainder being composed of peroxide of manganese and oxide of zinc in varying proportions. The oxides of manganese and zinc are said to exercise a very favourable influence upon the iron manufactured from this ore, increasing its tenacity, rendering it less liable to rust, and fitting it for easy conversion into the finest steel.

Freestone.—Any rock which admits of being freely cut and dressed by the builder; generally applied in Scotland to the varieties of sandstone.

French Chalk.—A white or greyish-white variety of steatite, used for removing stains from silk, for slate-pencils, and, in powder, for lessening friction.

Freshet.—A river-flood or inundation, occasioned by the sudden melting of the ice and snow in spring; the predominance of fresh water in tidal estuaries, during periodical rainfalls and land-floods.

Friable (Lat. *frio*, I grind or crumble).—Easily broken into small pieces; easily crumbled or reduced to powder. The opposite of *tough* or *tenacious*.

Fringing-Reefs.—A class of coral-reefs, known also as "shore-reefs," from their fringing or encircling islands at a moderate distance from shore. "They differ from barrier-reefs," says Darwin, "in not lying so far from shore, and in not having within a broad channel of deep water." The reefs which fringe the island of Mauritius form a good example of the class.—See CORAL-REEFS.

Frith, Firth (Lat. *fretum*).—An arm of the sea, as the Frith of Forth, the Frith of Tay, &c. Originally applied to any strait narrow passage, or inlet.

Frond (Lat. *frons*, a branch).—In botany, the term applied to the foliaceous or leaf-like part of ferns and other flowerless plants. The frond differs from a true leaf both in structure and function, and combines as it were branch, leaf, and fructification in one organ.

Frost (Sax.).—In meteorology, the freezing, or conversion into ice, of water and watery vapours by the influence of cold. In ordinary circumstances water passes into ice when the temperature of the air falls to 32° of Fahrenheit; but as the cold increases the frost becomes more intense, and substances (such as oils, mercury, &c.) which remained liquid at 32°, gradually lose their caloric and pass into the solid state. As a geological agent, frost exerts a purely mechanical influence, but this influence is of prime importance in disintegrating rocks and soils, moulding the contour of mountains, and assisting in the dispersion of boulders and other debris, not only from higher to lower levels, but from the land over the bottom of the ocean. Thus, the rain and moisture that enter the fissures of cliffs, and between the particles of all rocky matter, are often frozen during winter, and in this state of ice expand and force apart these rocks and particles. When thaw comes, the particles, having lost their cohesion, fall

asunder; and thus, under all latitudes and at all altitudes, where frost occurs, vast waste is every winter effected—and this in proportion to the intensity of the cold, which may range from freezing to 60° below freezing, and according to the rapidity and frequency of the alternations from fresh to freezing. It is also by the action of frost that avalanches, glaciers, and icebergs are formed on mountains above the snow-line and in arctic regions: the *avalanche* of snow and ice, which, losing its coherence, is launched from the mountain-side, carrying masses of rock and soil and trees before it—the *glacier*, or ice-lake, that gathers in the mountain-glen above, and slowly grinds its way to the valley below, smoothing the rocks in its passage, and leaving as it melts away its lateral and terminal ridges of gravel and debris, technically termed “*moraines*”—and the *iceberg*, detached by fracture from the projecting glacier of some arctic shore, that floats its burden of rock and gravel to warmer latitudes, there to drop them as it melts away on the bottom of the ocean. In the study of frost-operations, whether among the cliffs and gorges of mountains like the Alps and Himalayas, or along the shores of the Arctic Ocean, the observer discovers at once an important cause of present change and a key to the solution of some of the most interesting of geological problems.—See ICE, ICEBERG, &c.

Fucivorous (Lat. *fucus*, sea-weed, and *voro*, I devour).—Literally “*fucus-eating* ;” applied to animals that subsist on sea-weeds, *e.g.*, the “*fucivorous molluscs*,” the “*fucivorous cetaceans*,” &c.

Fucoides (*fucus*, sea-weed, and *eidos*, likeness).—The generic term for any fossil *fucus* or *fucus*-like organism of unknown affinity.

Fucoids (*fucus*, sea-weed, and *eidos*, likeness).—Fucoids, or *fucus*-like impressions, occur in strata of every epoch, from the Lower Silurians to the Upper Tertiaries. Such terms, therefore, as “*fucoidal sandstones*,” “*fucoidal shales*,” &c., are not unfrequent in geological descriptions.

Fulgorite, **Fulgorite** (Lat. *fulgur*, lightning).—Any rocky substance that has been fused or vitrified by lightning. More strictly applied to a bore or tube produced by the passage of lightning into a sandy soil, which it sometimes penetrates to a depth of twenty feet, fusing and vitrifying the sand and gravel in its downward progress. *Fulgorites* are occasionally dug up in the sandy plains of Silesia and Eastern Prussia.

Fuller's Earth.—A term applied to certain soft unctuous clays (hydrous silicates of alumina) of the Oolite and Chalk systems, from their being employed in the fulling of woollens. Good fuller's earth is usually massive, opaque, soft, dull, with a greasy feel and an earthy fracture; scarcely adheres to the tongue, and when placed in water falls down to an impalpable powder without forming a paste with it. So important at one time was this earth to the woollen manufacture of England that its exportation was prohibited by act of Parliament. Its place is now mainly supplied by soap and other detergents, though considerable quantities are still dug and prepared for the fuller in Surrey and Bedfordshire. In geological classification the term is applied to an argillaceous stratum (“the Fuller's Earth”) which lies between the Great and Inferior Oolites, near Bath.

Fumarole (Ital. *fumare*, to smoke).—An opening or orifice, in a volcanic district, from which ~~smoke~~ and other gaseous fumes are emitted.

Fungia, **Fungidae**.—A genus and family of single lamellated corals, so called from the resemblance of their stony structure to that of a fungus or mushroom. They are of a depressed form, have the under surface scab-

rous, and are divided above by numerous lamellæ or plates, which radiate from a central oblong depression. The original genus *Fungia* of Goldfuss is now broken up into *micrabacia*, a form peculiar to the Chalk and Greensand, *anabacia* to the Oolite, and *palæocyclus* to the Silurian system.

Fungoid, Fungiform (Lat. *fungus*, a mushroom, and *eidos*, likeness).—Applied to nodular excreescences and petrifications which resemble the clustering tubercular growth of the fungus; also to single structures (e. g., certain corals) which resemble the mushroom in form.

Fúniform (Lat. *funis*, a cord or cable).—Cord-like; rope-like; resembling a cord or cable in appearance.

Fusible Metal.—An alloy of eight parts of bismuth, five of lead, and three of tin, which melts at the boiling-point of water (212° F.), and may be fused over a candle in a piece of stiff paper, without burning the paper.

Fusible Quartz.—A term occasionally applied by the older mineralogists to *obsidian*, which see.

Fúsiiform (Lat. *fusus*, a spindle, and *forma*, likeness).—Spindle-shaped; thickest in the middle, and tapering towards the extremities; e. g., shells of the genus *Fusus* or "spindle-shell."

Fusion (Lat. *fusus*, melted, from *fundo*, I pour out).—The state of melting. Solid substances, as iron, basalt, &c., when rendered fluid by the application of heat, are said to be in a state of *fusion*. Substances which admit of being melted are termed *fusible*; those which resist the action of fire are termed *refractory*.

Fusulina (Lat., a little spindle).—A genus of foraminiferous organisms, occurring in the Carboniferous formation, and so termed from their fusiform shells, which are elongated transversely—the cells being divided internally by constrictions. Regarded as the earliest and most ancient type of the Foraminifera yet known.

Fusus (Lat., a spindle).—An extensive genus of gasteropods belonging to the *Muricidæ* or *Murex* family, having a world-wide distribution, and occurring also in a fossil state from the Oolite upwards. The spindle-shell, red-whelk or *buckie* of our own shores, may be taken as a type. They inhabit sandy or muddy bottoms, and have a range from 5 to 70 fathoms.

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Gábbro.—An Italian term for a rock consisting essentially of diallage and felspar; the *euphotide* of French geologists, and the *Verde di Corvica duro* of artists.

Gad.—In mining, a pointed wedge of a peculiar form, much used in Cornwall for underground purposes; hence the title "Pick and Gad" at one time adopted for a mining periodical.

Gadolinite.—A greenish-black mineral, occurring massive, and in granular and prismatic concretions, in granitic and felspathic rocks. It is named after the Russian chemist Gadolin, who, in 1794, discovered the earth *yttria* in specimens obtained from Ytterby in Sweden. According

to Berzelius, it consists of 45.93 yttria, 24.16 silica, 16.90 protoxide of cerium, 11.34 protoxide of iron, with traces of magnesia, lime, and glucina. When heated, Gadolinite becomes incandescent, but undergoes no change in weight—a property which Rose ascribes to the liberation of specific heat, the quantity in the mineral before and after ignition being different.

Gahnite.—Known also as *Automalite*; a native aluminate of zinc, named after its discoverer, Gahn.

Galecyne (Gr. *gale*, weasel, and *kyon*, dog).—A term applied by Owen to the remains of a viverrine fox, from the fresh-water Tertiary (Miocene) deposits of Keningen—the characters of the bones indicating a genus intermediate between the polecats and dogs—that is, *viverra* and *canis*.

Galéna (Gr. *galeo*, I shine).—Native protosulphide of lead; lead-glance. So called from its bluish-grey colour and metallic lustre. Galena is the chief ore of lead in this country, occasionally occurring in crystals, but most frequently massive, and disseminated in granular, compact, or laminar aggregates. It is found in veins in the crystalline rocks, and abundantly in the Carboniferous limestone. It usually contains a small proportion of silica, varying from 1.03 to .06 per cent, and very rarely amounting to 1 per cent. Small percentages of antimony, iron, zinc, and the like, occur in most British ores.

Galeocerdo (Gr.)—Literally “fish-fox;” a genus of sharks, whose broad-based, sharp, serrated teeth occur from the Lower Tertiaries upwards.

Galerites, Galeritidae (Lat. *galea*, a helmet).—A genus and family of sub-conical, helmet-shaped sea-urchins abounding in the Chalk formation, and from their shape popularly known in Kent and Sussex as “sugar-loaves.” In the *Galeritidae* the shell is high and much inflated, more or less conical above, and oblong-oval at the base, narrowing towards the hinder part. The ambulacra are simple, never petalloid; the poriferous zones extend from the summit to the mouth, which is situated in the centre of the base; the outlet near the posterior margin. One of the most abundant species is the *albo-galerus*, so termed from its fanciful resemblance to the white conical caps of the priests of Jupiter.

Galesaurus (Gr. *gale*, polecat, and *saurus*, lizard).—A provisional genus of Crocodilians, founded on an entire cranium and lower jaw, from the sandstone rocks of Rhenosterberg, South Africa; and so named by Professor Owen from the resemblance of its dentition (which is quite of a mammalian character) to that of the weasels and polecats. This peculiarity of dentition is regarded by its describer as “a singular and suggestive approach to the mammalian class.”

Galionella (Lat., a small helmet).—An abundant genus of Diatoms or microscopic plant-growths, so called from the cylindrical, globular, or helm shape of their siliceous shields. They are free, but usually occur in chains; and abound in pools and lakes, as well as in Tertiary marls and other microphytal earths.

Gallery.—In mining, a working drift or level from which the mineral has been excavated.

Gang, Gangue.—The German term for a vein or lode; literally a course or passage.—*Gangue*, the vein-stone, vein-stuff, or matrix in which the metallic ore occurs.

Ganglioneura (Gr. *ganglion*, a knot, and *neuron*, nerve).—Literally “knotted nerve;” a name applied by Rudolphi to the articulate and molluscous divisions of the animal kingdom, because characterised by a

ganglionic type of the nervous system. In the Articulata the ganglia are always disposed symmetrically along the middle line of the body, and brought into communication by a double chord; whence these have been termed *Homogangliata*. In the Mollusca, on the other hand, the ganglia are dispersed and placed at a distance from each other, and from the mesial line, and are frequently unsymmetrical in their arrangement; hence these have been termed *Heterogangliata*.

Gánister, Gannister.—The local name for a fine hard-grained grit which occurs under certain coal-beds in Derbyshire, Yorkshire, and the north of England.

Ganocéphala (Gr. *ganos*, lustre, and *kephale*, the head).—One of the orders into which Professor Owen proposes to arrange the Reptilia, living and extinct. The term has reference to the sculptured and externally polished or ganoid bony plates with which the entire head is defended. The order embraces the *Archagosaurus* and other allied palæozoic forms, which, in addition to the peculiar bones of the head, are characterised by the absence of occipital condyles, by the persistence of the notochord (the vertebral arches and peripheral elements being ossified), by small natatory pectoral and pelvic limbs, by large median and lateral throat-plates, by their small, narrow, and sub-ganoid scutes, and, in some, by traces of branchial arches.

Ganoid, Ganoidæan (Gr. *ganos*, splendour, and *eidos*, likeness).—The second order of fishes in Agassiz's arrangement. They have angular scales regularly arranged, and composed of horny or bony plates, covered with a strong shining enamel. The *Ganoideans* are chiefly palæozoic and extinct forms: the bony pike of Canada and the sturgeon are living examples.

Garnet (Fr. *grenat*, Ital. *granato*, quasi *granum*, a grain).—In modern systems of mineralogy the garnets constitute an extensive but extremely variable family, according as alumina, iron, lime, magnesia, or similar bases, are associated with the silica, which composes about half the mineral. They are all, in fact, silicates of one or more of these bases, and are usually arranged into six sections—viz., lime-garnets, magnesia-garnets, iron-garnets, manganese-garnets, iron-lime-garnets, and lime-chrome-garnets. They occur chiefly in mica-schist and other crystalline strata, but are found also in granite, trap, and other igneous rocks. The garnet proper appears in dodecahedral crystals and druses, in grains, occasionally in thin subordinate bands, or so thickly studding portions of the gneiss and mica-schist that millstones have been made from the mass. The colour of the garnet is usually a deep amber-red, reddish-brown, or black, but occasionally olive-green passing into yellow; its lustre is vitreous or resinous; and it is transparent in all degrees. Of the better-known varieties we may mention the *Almandine* or noble garnet, of a beautiful columbine-red; the *Grossular* or olive-green; the *Hessonite* or *Cinnamon-stone*; the *Colophonite* or resinous garnet; the *Pyrope* or fire-garnet; the *Topazolite*, and the common iron-garnets so abundant in most localities.

Garúa.—The local term for dense sea-fogs that occur periodically along the Pacific coast of South America. During the Garúa, it is said, the atmosphere loses its transparency, and the sun is obscured for months together. The vapours of the Garúa of Lima are so thick that the sun, seen through them with the naked eye, assumes the appearance of the moon's disc. They commence in the morning, and extend over the plains in the

GAS — GAY

form of refreshing fogs, which disappear soon after mid-day, and are followed by heavy dews, which are precipitated during the night.

Gaseous (Teut. *gas*, air or breath).—In the form of gas; consisting of gas—*gas* being the term applied to all permanently elastic or æriform fluids, except the atmosphere, which is an admixture of two or more gases. In nature the gases play an important part, and geologically speaking, are of vast significance. Some, like oxygen and carbonic acid, are continually corroding, wasting, and forming new compounds; others, like carbonic acid, sulphuretted hydrogen, and carburetted hydrogen, are largely disengaged from the crust of the earth by volcanic vents, springs, mines, and other openings; some again, as oxygen, carbonic acid, and nitrogen, are indispensable to vegetable and animal life; while others, as oxygen and hydrogen, form permanent combinations, as in the rocks of the crust, the atmosphere that surrounds it, and the waters which cover so large a portion of its surface.

Gasterópoda (Gr. *gaster*, the belly, and *pous, podos*, a foot).—An extensive class of mollusca which, like the periwinkle and garden-snail, have a distinct head, and move by means of a muscular foot attached to the lower part of the body; hence the term “belly-footed.” Representatives of the class occur in all formations, from the Silurian upwards; but both genera and species increase in ascending order.—See tabulations, “**ANIMAL SCHEME.**”

Gastónis (*Gaston*, after M. Gaston Plante, the discoverer, and *ornis*, bird).—A provisional generic term applied to certain bird-remains from the Eocene Tertiaries of Meudon, near Paris. The leg and thigh bones are the only portions yet discovered, and these indicate a bird as large as an ostrich, but more robust, and having affinities to wading and aquatic orders—that is, of an extinct genus intermediate between the *grallatores* and *cursoræ*.

Gault, Golt.—A provincial term, and now adopted in geology, for that series of dark-blue marls or calcareous clays which occur between the upper and lower greensands of the Chalk formation, as developed in the south of England. It is sometimes known as *Folkstone Marl*; ranges from 100 to 150, or even occasionally to 200 feet, in thickness; and abounds in marine shells—ammonites, hamites, scaphites, belemnites, inocerami, &c., often in a beautiful state of preservation. When decomposed, it forms a strong fertile soil; and, according to Mr Austin, is the main repository of those “phosphatic nodules” now so highly prized by the agriculturist.

Gavial.—The Gavial or Gangetic Crocodile; an existing genus and species of crocodile, characterised by its prolonged, slender snout, which terminates in a cartilaginous protuberance, in which the nostrils are situated—by its numerous teeth, of nearly equal size throughout the whole of the jaws—and by its hind feet, which are palmated to the extremities of the toes. Slender-snouted crocodiles of closely allied forms—*teleosaurus*, *stenesocaurus*, &c.—occur in the Lias, Oolite, and Wealden.

Gaylenreuth.—A village of Franconia in Germany, celebrated for its Bone-Cave, which lies to the north-west of the village, on the left bank of the Wiesent, which has cut its channel through the limestone. According to Cuvier, who examined large collections of the bones, three-fourths of them belonged to bears (*ursus spelæus*, and *priscus*); and the remaining portion to hyenas, tigers, wolves, foxes, gluttons, and other small carnivora.

Gay-lussite (after the French chemist, Gay Lussac).—Hydrated carbon-

ate of lime and soda; a mineral occurring in the natron beds of South America, in long nail-like transparent prisms, and consisting of 34.5 carbonate of soda 33.6 carbonate of lime, and 30.4 water. It is slowly and partially soluble in water.

Gehlenite.—One of the Scapolite family; a mineral occurring in small greenish or greyish-brown four-sided prisms, along with calc-spar, in Mount Monzoni in the Fassa Valley, and so named after Gehlen the chemist. It is a ferro-silicate of alumina and lime, and closely allied to *Humboldtite*.

Gem (Lat. *gemma*).—A general term for any precious stone. In mineralogy the "Gems," which include the ruby, sapphire, topaz, emerald, &c., are usually erected into a separate *family*, and, as Professor Nicol observes, "notwithstanding their diverse chemical composition, must ever appear a highly natural one, when regarded as individual objects. Their great hardness, tenacity, high specific gravity without the metallic aspect, their brilliant lustre, transparent purity, and vivid colours,—all mark them out as a peculiar distinct family. Only the diamond, which might naturally seem to take the chief place in this class, differs so much, not only in elementary composition, but in physical properties, that it must be assigned to a diverse place in the system." Gems are usually arranged into *real gems*—the diamond, sapphire, ruby, spinelle, &c., which have great hardness, lustre, and colour—and *precious stones*, which have the same characters as the real gems, but only possess them in a less degree. The term *Oriental* is applied as a mark of excellence, whether coming from the East or not. Gems are also spoken of as *natural* and *artificial*; the latter being composed of vitreous "pastes," coloured by different metallic oxides.

Gemmparous (Lat. *gemma*, a bud, and *pario*, I bring forth).—In physiology, reproducing by buds on the body, which mature and fall off, and then become independent animals, as in many of the infusoria.

Genus (Lat., kind or kindred).—In natural history, the word *genus* has often wide, and not well-defined limits, but is generally regarded as embracing such members of a Family or larger group as possess some common properties, more marked in them than in the other members of the family. Thus the *Canids* or Dog family embraces the dog, wolf, jackal, fox, &c.; but the dog, wolf, and jackal are regarded as one genus, *Canis*, while the foxes are separated into another genus, *Vulpes*, the points of agreement between the dog and wolf being more numerous and intimate than between the dog and fox. The other *permanent* differences between the individuals of the same genus constitute a *species*; and the *accidental* differences found among the species give rise to *varieties*.

Geodes (Gr. *geodes*, earthy).—Originally applied to nodules of indurated clay or ironstone, hollow within, filled with soft earthy ochre, or having a free nucleus or kernel, which rattled when the nodule was shaken; the *aites*, or eagle-stone, of the ancients. The term is now generally employed to denote all rounded nodules having internal cavities, whether empty, nucleated, or lined with crystals. Locally and familiarly known as "potato-stones," "cat-heads," and similar fanciful terms.

Gegnomy (Gr. *ge*, the earth, and *gnosis*, knowledge).—A term invented to express absolute knowledge of the earth, in contradistinction to *Geology*, which embraces both the facts and our reasonings respecting them. The term, however, is seldom used by British geologists.

Geogony (Gr. *ge*, the earth, and *gonos*, generation).—Like cosmogony, geogony consists in abstract speculations regarding the original formation

of the earth, and is altogether distinct from the definite and intelligible science of geology.

Geology (Gr. *ge*, the earth, and *logos*, doctrine).—Embraces all that can be known of the constitution and history of our planet. Its object is to examine the various rock-materials of which our planet is composed, to describe their appearance and relative positions, to investigate their nature and mode of formation, and generally to discover the laws which seem to regulate their arrangement. As thus defined, the science may be viewed in three great aspects—Descriptive, Theoretical, and Practical: *Descriptive Geology* being that which restricts itself to a consideration of facts and appearances as presented in the rocky crust; *Theoretical*, that which attempts to account for the phenomena, and arrange them into a connected world-history; and *Practical*, that which, guided in its researches by the other two, treats of the mineral products of the globe, the methods of obtaining them, and their application to industrial or economic purposes.

Geosaurus (Gr. *ge*, the earth, and *sauros*, a lizard).—A gigantic terrestrial reptile of the Oolitic epoch.

Geotuthis (Gr. *ge*, the earth—that is, fossil—and *teuthis*, a squid).—A genus of fossil squids or calamaries, whose short broad *pens*, pointed behind, and truncated in front, with lateral wings shorter than the shaft, occur abundantly and in many species in the clays of the Lias and Oolite. Besides the *pens* of this calamary, the *ink-bag*, the muscular mantle, and the bases of the arms, are preserved in the Oxford clay. Some of the ink-bags found in the Lias are nearly a foot in length, and are invested with a brilliant nacreous layer; the ink, like that of the recent analogues, forming excellent *sepia*. It is difficult to understand how these ink-bags were preserved, as the existing calamaries “spill their ink” on the slightest alarm; unless we suppose, with Dr Buckland, that their possessors were instantaneously enveloped in the muddy deposit that now entombs them.

Gervillia (dedicated to M. Gerville, a French naturalist).—A genus of the Aviculidæ, or wing-shells, found fossil in many species, from the Carboniferous system to the Chalk inclusive. Shell like *avicula*; elongated, anterior ear small, posterior ear wing-like; area long and flat, cartilage pits several wide apart; hinge-teeth obscure, diverging posteriorly.

Geyser (literally “rager” or “roarer”).—An Icelandic term for the intermittent boiling-springs, or spouting fountains, which occur in connection with the volcanic phenomena of that island. “These intermittent hot springs occur in a district situated in the south-western division of Iceland, where nearly one hundred of them are said to break out within a circle of two miles. They rise through a thick covering of lava, which may perhaps have flowed from Mount Hecla, the summit of that volcano being seen from the spot, at the distance of more than thirty miles. In this district the rushing of water is sometimes heard in chasms beneath the surface; for here, as on Etna, rivers flow in subterranean channels through the porous and cavernous lavas. It has more than once happened, after earthquakes, that some of the boiling fountains have increased or diminished in violence and volume, or entirely ceased, or that new ones have made their appearance—changes which may be explained by the opening of new rents, and the closing of pre-existing fissures. Few of the geysers play longer than five or six minutes at a time, and the intervals between their eruptions are for the most part very irregular. The Great Geyser rises out of a spacious

basin at the summit of a circular mound, composed of siliceous incrustations, deposited from the spray of its waters. The diameter of this basin in one direction is fifty-six feet, and forty-six in another. In the centre is a pipe seventy-eight feet in perpendicular depth, and from eight to ten feet in diameter, but gradually widening as it rises into the basin. The inside of the basin is whitish, consisting of a siliceous crust, and perfectly smooth, as are likewise two small channels on the sides of the mound, down which the water escapes when the bowl is filled to the margin. The circular basin is sometimes empty, but it is usually filled with beautifully transparent water in a state of ebullition. During the rise of the boiling water in the pipe, especially when the ebullition is most violent, and when the water is thrown up in jets, subterranean noises are heard, like the distant firing of cannon, and the earth is slightly shaken. The sound then increases, and the motion becomes more violent, till at length a column of water is thrown up, with loud explosions, to the height of one or two hundred feet. After playing for a time like an artificial fountain, and giving off great clouds of vapour, the pipe or tube is emptied, and a column of steam rushing up with amazing force, and a thundering noise, terminates the eruption. If stones are thrown into the crater, they are instantly ejected; and such is the explosive force, that very hard rocks are sometimes shivered by it into small pieces. Henderson found that, by throwing a great quantity of large stones into the pipe of Strocker (churn), one of the geysers, he could bring on an eruption in a few minutes. The fragments of stone, as well as the boiling water, were thrown in that case to a much greater height than usual. After the water had been ejected, a column of steam continued to rush up with a deafening roar for nearly an hour; but the geyser, as if exhausted by this effort, did not send out a fresh eruption when its usual interval of rest had elapsed."—(Lyell's 'Principles,' as condensed from Barrow, Henderson, Mackenzie, and others who have visited Iceland.) Various theories have been proposed to account for the phenomena of the geysers, but that proposed by Sir G. Mackenzie, and which connects the intermittent eruptions of steam and water with the formation and expansion of steam in caverns and fissures in the lava beneath, is that which is generally accepted. It is obvious, if fissures and caverns exist, that steam of a very high pressure must be found in them by the passage of the boiling waters along the subterranean channels; and as the pressure increases, the steam will force itself forward, and escape by the nearest opening. Once discharged, it will require some time before another supply can be formed of the requisite pressure and temperature. According to Mr Roberts, all the waters issuing from these springs are highly charged with silica; hence siliceous incrustations and deposits cover the adjacent country to the extent of four leagues, and the streams proceeding from the springs often resemble milk in appearance, owing to the argillaceous bole they take up in their passage among the siliceous concretions (palagonite tufa) and accumulations.

Géyserite.—The name given to a loose, porous, hydrated form of silica deposited in concretionary, cauliflower-like masses around such hot springs as the geysers of Iceland, those of the Sierra Nevada in California, and other regions.

Ghauts.—A term applied originally to the narrow and difficult passes in the mountains of Central Hindostan, but has been gradually extended to the mountains themselves—viz., the Eastern and Western Ghauts, which

consist of two great chains, stretching along the east and west coasts of the Deccan or Indian Peninsula.

Gibbous (Lat. *gibbus*, bunched, humped).—Applied to forms that have a suddenly convex, or hump-like external surface. Bossed; abruptly protuberant, like the upper surface of the *cypræa gibbosa* or hump-backed cowry.

Giraffe.—The tallest of known quadrupeds, and now restricted to the deserts of Africa, was once a native of Europe and Asia, for fossil bones of a species of this remarkable ruminant have been found in the Upper Tertiaries of Issoudun in France, at Pikermi in Greece, and in the Siwalik Hills in Hindostan, associated with varieties of the Elk, Deer, &c.

Girasol, Gyrasole (Lat. *gyro*, I turn, and *sol*, the sun).—Known also as *fire-opal*; a transparent variety of opal, having a brilliant vitreous lustre, and of a bright hyacinth red, particularly when turned towards the sun, or any bright light: hence the name. The finest specimens are strongly translucent, and show a faint bluish light, coming as it were from the interior of the stone.

Glacier (Lat. *glacies*, ice).—Applied to those accumulations of ice, or of snow and ice, which collect in the valleys and ravines of snowy mountains like the Alps, and which move downward with a peculiar creeping motion, smoothing the rocks over which they pass, and leaving mounds of debris (*moraines*), lateral and terminal, as they melt away. According to Saussure, glaciers are of two kinds—those formed in valleys and following the windings of their courses (the *ice-river*), and those formed in the slopes and higher peaks of the mountains in sheet-like masses. In both, the mode of action is almost identical; and, combined with the *avalanche* and *iceberg*, the glacier is now, as it has been in ages past, one of the most important of geological agents. The evidence of glaciers in any country, during former epochs, consists partly in the polished and grooved surfaces of the rocks over which they slid with their impacted boulders and shingle (these scratching and grooving in the direction of that movement); and partly by the peculiar contour and composition of the moraines, which differ materially from beds of debris brought down by torrents and other currents of water. As glaciers can only be formed above the line of perpetual congelation, and melt when they descend to and below that level, important inferences as to climate can often be drawn from the occurrence of moraines, rock-groovings, and other kindred phenomena.

Glacier-Table.—The name given in Alpine regions to large table-like blocks of stone lying on the surface of glaciers, and more or less elevated on pedestals of ice—these pedestals being protected from the sun's rays by the superincumbent stone-blocks while the surrounding ice has been melted down to a lower level.

Glacis (Fr.)—A slope in fortification; applied to easy insensible slopes like those of a harbour-breakwater, or the shingle piled on the shore by the force of the waves; less steep than a *talus*.

Glance (literally, *splendour*).—A frequent term of the earlier mineralogists, and applied to such minerals as exhibited a glancing or pseudo-metallic lustre, as lead-glance, iron-glance, glance-coal, &c. The term is now seldom employed.

Glance-Coal.—A familiar term for anthracite (which see), in allusion to its semi-metallic lustre.

Gläserite.—A sulphate of potash, occurring in delicate white or yellow-

ish-white crystallisations, and in crusts and masses, sublimed around the fumeroles of active volcanoes. It has a semi-resinous lustre, is more or less translucent, and has a saline and bitter taste. Specimens from Vesuvius contained 71.4 sulphate of potash, 18.6 sulphate of soda, 4.6 chloride of sodium, and 5.4 chloride of ammonium, copper and iron.

Glass.—The well-known silicates of potash and soda (quartz-sand fused with one or other of these alkalies); but which are variously compounded to give them colour, transparency, toughness, &c. Thus *green* or *bottle glass* consists of the silicates of alumina, of the oxides of iron, magnesia, and potash, or soda; *flint-glass*, a silicate of potash and lead; *window-glass*, a silicate of soda and lime; and *plate-glass*, silicate of potash and lime. In mineralogy, the term *glass* is applied to several substances having a glassy appearance, as *Muscovy-glass* or mica, *tin-glass* or bismuth, *glass of antimony* or sulphuret of antimony.

Glauberite.—A rare crystallised salt, occurring in oblique four-sided prisms, and consisting of 51 parts sulphate of soda and 49 sulphate of lime. It is found associated with rock-salt in Spain, South America, and other localities, and is so named from containing a large amount of Glauber-salt.

Glauber-Salt (after Glauber, a German chemist).—Native sulphate of soda; the *sal-mirabile* of the older chemists. It occurs chiefly as an efflorescence in quarries and on old walls, as in the salt-mines of Austria, Spain, and other countries; it is deposited in great abundance from the hot springs at Carlsbad, and is found in many other mineral waters; and is likewise procured from salt springs, and forms a crust or efflorescence on the borders of salt lakes in Egypt, Southern Russia, and other countries.

Glaucolite (Gr. *glaucos*, bluish-green, sea-green, and *lithos*).—A pale-blue or greenish variety of Labrador felspar, from Lake Baikal in Siberia.

Glaucónie, Glaucónie Crayense.—The French term for certain strata (bluish chalky marls and greensands) which appear to be on the same horizon with, and in part the equivalents of, our Upper Greensand and Gault.—See CRETACEOUS SYSTEM.

Glaucónite (Gr. *glaucos*, bluish-green).—A mineral forming small round grains in the greensand of England, France, Germany, and North America, and very similar in colour, &c., to *green-earth*, but seems essentially a hydrous silicate of iron protoxide and potash. In green-earth, the iron is in the state of *peroxide*.

Glen Roy, Parallel Roads of.—"Glen Roy," says Sir Charles Lyell in his 'Antiquity of Man,' is situated in the Western Highlands, about ten miles north of Fort William, near the western end of the great glen of Scotland, or Caledonian Canal, and near the foot of the highest of the Grampians, Ben Nevis. Throughout nearly its whole length—a distance of more than ten miles—three parallel roads or shelves are traced along the steep sides of the mountains, each maintaining a perfect horizontality, and continuing at exactly the same level on the opposite side of the glen. Seen at a distance, they appear like ledges or roads cut artificially out of the sides of the hills; but when we are upon them, we scarcely recognise their existence, so uneven is their surface and so covered with boulders. They are from ten to sixty feet broad, and merely differ from the side of the mountain in being somewhat less steep. On closer inspection we found that these terraces are stratified in the ordinary manner of alluvial or littoral deposits. . . . Numerous and diverse theories have been proposed

to account for these 'roads' or shelves; but on one point they are all agreed—namely, that they are ancient beaches, or littoral formations, accumulated round the edges of one or more sheets of water which once stood for a long time successively at the level of the several shelves."

Glimmer.—The term applied by Werner to the several varieties of mica; by Haidinger and Hausmann to the variety called *muscovite*; and also occasionally used to designate talcose and micaceous compounds.

Globigerina (Lat. *globus*, a sphere, and *gero*, I carry).—A genus of foraminiferous organisms, whose many-celled shell is turbinated, cells spheroidal, and the last or terminal one furnished with a semicircular aperture at the umbilical angle. Several fossil species abound in the Chalk and in Tertiary deposits; and many species still swarm in our seas. Indeed, a large proportion of the ooze or calcareous mud brought up during the soundings of the Atlantic telegraph route consisted of Globigerinæ, partly in the living state, but chiefly in fragments, which formed a mud almost of the consistency of putty, and which, when dried, was scarcely distinguishable from a mass of soft, yellowish chalk.

Globular (Lat. *globus*, a ball).—Round; applied to forms more or less spherical. *Globule*, any minute rounded particle.

Glossopetra (Gr. *glosse*, the tongue, and *petra*, stone).—Literally "tongue-stone;" an early term for the flattened tongue-shaped shark's teeth, so abundant in many of the Upper Secondary and earlier Tertiary formations. Known also as *Lamiodontes* or throat-teeth, and *Odontopetra* or teeth-stones.

Glossopteris (Gr. *glosse*, tongue, and *pterus*, fern).—A genus of Oolitic ferns, so called from their tongue-shaped leaves (which were four-parted), and now known as *Sagenopteris*, which see.

Glottalite (Lat. *Glotta*, the Clyde, and *lithos*).—A variety of analcime occurring in small aggregated and irregular white or colourless crystals in the trap walls near Port-Glasgow on the river Clyde, whence the name.

Glucina (Gr. *glucos*, sweet).—A rare earth, discovered by Vauquelin in 1798, and constituting nearly 14 per cent of the emerald and beryl, which owe to it their fine green colour. It combines with all the acids, and forms, with them, sweetish salts: hence its name. According to Sir H. Davy, it is an oxide of *glucinum*—a metallic basis not yet obtained in a separate state.

Glyphæa (Gr. *glyphe*, sculpture).—A genus of small lobster-like crustaceans (*Astacidae*), whose carapaces occur in the Oolite of England; and so termed from the sculptured ornamentation of their outer surfaces.

Glyptocrinus (Gr. *glyptos*, sculptured).—A genus of Lower Silurian enocrinites, characterised by their highly-ornamented basal plates; whence the name.

Glyptodon (Gr. *glyptos*, sculptured, and *odus*, tooth).—So named from the deeply-grooved teeth; a gigantic edentate animal from the Upper Tertiaries of South America; allied to the armadilloes (*Dasyrina*), and furnished with a carapace or coat of mail, formed of polygonal bony plates, united by sutures, which constituted an impenetrable covering for the upper part of the body. The plates of this bony integument were not disposed in rings as in the armadillo, but were articulated to each other and formed a tessellated cuirass; the tail was enclosed in a case of this kind, like a sword in its scabbard.—See *DASYPUS*.

Glyptostrobis (Gr.)—Literally "carved cone;" a genus of coniferous

fruits occurring in the Upper Miocene beds of Öeningen, and so named from their resemblance to the Japanese *G. heterophyllum*, now common in our shrubberies.

Gmelinite (after Gmelin, the German chemist).—A soda-chabasite, occurring in amygdaloidal trap-rocks in flat six-sided prisms, terminated at both extremities by truncated six-sided pyramids; of a white or yellowish-white colour; vitreous lustre; translucent; and having the surface of the prisms striated horizontally.

Gneiss.—Originally a German term for a peculiar granitic-looking rock occurring at the very base of the so-called "Primary strata;" but now applied not only to the rock properly so-called, but to the whole suite of hard crystalline granitoid schists which constitute the lowest portion of the metamorphic or non-fossiliferous strata. As a rock, it occurs in three main varieties—viz., *Gneiss Proper*—an aggregate of quartz, felspar, and mica, occasionally garnetiferous; *Porphyritic Gneiss*—the same as preceding, with large irregular macles of felspar or quartz; and *Syenitic Gneiss*—of quartz, felspar, and hornblende. As a suite, or portion of the metamorphic system, it consists of irregularly interstratified schists—gneiss, mica-schist, quartz-rock, crystalline limestones, &c.—all of which have been subjected to less or greater intensity of metamorphic action, though originally deposited as muds, clays, and sands. In whatever state of aggregation the particles of *Gneiss* may have been when originally deposited, we know that it is now a hard, tough, crystalline rock, exhibiting curved and flexured lines of stratification, and composed in the main of quartz, felspar, mica, and hornblende. Mineralogically speaking, it differs from the granitic rocks with which it is associated chiefly in this, that while the crystals of quartz, felspar, &c., are distinct and entire in granite, in gneiss they are indistinct, and confusedly aggregated. There is also this essential distinction, even where the mineral aspects of the two rocks are most alike, that the gneiss never sends out dykes and veins, like the granite, into contiguous strata; nor does it ever assume the tabular or sub-columnar structure so frequent in granite—a structure peculiar to rocks which are the products of cooling and consolidation from a state of igneous fusion. In the most granitoid masses of gneiss, the stratified disposition is never wholly obliterated; hence their *facility* in one direction as compared with the indeterminate and hackly *fracture* of the true igneous granites. Though GNEISS is thus (generally speaking) the oldest or lowest of the Primary strata, it may occur in any system, just as the strata of that system may have been subjected to the necessary metamorphic agency of heat and other mineralising conditions; and so it happens that many of the Secondary strata of the Alps are as highly crystalline as the Primary schists of the Grampians.

Gneissic, Gneissose.—Having the aspect of gneiss; partaking of the qualities of gneiss; exhibiting the crystalline texture and foliated and flexured structure of gneiss.

Goaf, Gob.—In mining, the waste or empty space left by the extraction of a seam of coal. It is in this "Goaf" that the most destructive accumulations of fire-damp generally occur.

Gobbin, Goafin.—A miner's term for the refuse of a coal mine which is thrown into the "Goaf" or worked-out portion, to assist in supporting the roof.

Gold (Ger.).—The most valuable and longest known of the metals. It

generally occurs native in capillary, thread-like, arborescent, and moss-like aggregates; in scales and grains (*granos*); and in rolled masses known as *pepúas* and *nuggets*. Very frequently it is found disseminated in minute microscopic particles or imperfectly formed crystals throughout the quartz or vein-stone in which it occurs. Geologically, it is distributed in veins, nests, and lodes in the Primary and Palæozoic schists, but is most frequently found in the sands, gravels, and debris which have arisen from the waste and disintegration of these schists during the later Tertiary and Post-tertiary periods. Thus, though worked in the vein-mines of Mexico, South America, the Rocky Mountains, and Australia, the main commercial supply is obtained from the auriferous sands and gravels of the Ural, Hungary, Africa, California, Brazil, Australia, and other gold-yielding districts—the drift-workings being inexhaustible, though capriciously fertile, while the veins and lodes are said to become poorer the deeper they are followed. Gold is one of the most widely-disseminated metals, being found in every known region; but rarely in such local abundance as to pay for its search, collection, and preparation. It is also frequently found in combination with other metals, as palladium, rhodium, and silver; and sometimes also in minute quantities in the metallic sulphides, as galena, iron and copper pyrites; but generally so disseminated as to require skilful and expensive methods of extraction and purification. Gold is said to occur most abundantly in mountain-ranges having a meridional direction; and, according to the observations of M. Laur in California, it is still in course of being deposited from hot siliceous springs along with iron, copper, and other metals—the gold being metallic or *native*, while the other metals are in the state of *ores*.

As a metal, it is characterised by its yellow colour; its extreme permanence in air and fire—being little tarnished by any amount of exposure, and melting at 2016° Fahr.; its usual hardness is about 2.6; its density or specific gravity from 18 to 19.4; its malleability is such that it may be beaten into leaves not more than $\frac{1}{1000}$ of an inch in thickness; and its ductility so great that one grain is capable of being drawn out into 500 feet of wire. It readily forms alloys with other metals; and in coinage as well as in the arts it is generally so alloyed (with copper, silver, &c.) to improve its hardness, and so render it better able to resist the tear and wear of circulation, handling, and cleaning. Gold is not acted upon by the common acids; but chlorine and nitro-muriatic acid corrode and dissolve it, forming a chloride of gold, which is soluble in water.

Gómpholite (Gr. *gomphos*, nail, and *lithos*).—A term applied by Brongniart to certain sandy conglomerates of the Middle Tertiary epoch which occur in vast thickness at the foot of the Alps in the great Swiss valley, where they are known as *Nagelfluë*, which see.

Goniáster (Gr. *gonia*, an angle, and *aster*, star).—A genus of fossil starfishes occurring in the Greensand, Chalk, and older Tertiaries, and popularly known as *Cushion-stars*. They are characterised by their solid pentangular bodies, which in some species are obtuse at the angles, and in others more or less pointed and arm-like. The ossicles of the disc are generally punctuated, and the margins are provided with a double series of larger plates bearing granules or short spines.

Goniatites (Gr. *gonia*, an angle).—A genus of the Ammonite family, so called from the angular or zigzag lines which mark the junctions or sutures of its chambers. In the goniatite, which ranges from the Devonian

to the Trias, and of which there are about 150 species, the shell is discoidal, sutures lobed, lobes simply angulated, siphuncle dorsal.

Goniômeter (Gr. *gonia*, a corner, and *metron*, a measure).—An instrument for measuring angles, particularly those of crystals. Two instruments have been specially used for this purpose—the common or *contact goniometer* invented by Carangeau, and the *reflecting goniometer* of Dr Wollaston.

Goniôpholis (Gr. *gonia*, corner or angle, and *pholis*, scale or scute).—Literally "angle-scute;" a genus of Crocodilians whose teeth, bones, and dermal scutes occur in the Purbeck and Wealden strata. So termed from the angular shape of its scutes, many of which are furnished with a lateral projection, which fits into a corresponding depression of the adjoining scute, thus connecting and giving great strength to the dermal cuirass. Popularly known as the "Swanage Crocodile," from the fine specimen now in the British Museum, having been discovered in the Purbeck beds of that locality in 1835.

Gorgônia, Gorgonidæ (*Gorgones*, fabled personages whose heads bristled with serpents instead of hairs).—A genus of Anthozoan corals, so called from their branching flexible axes; and popularly known as "Venus's fans" and "Sea-fans," from their spreading fan-like forms. The Gorgonias are attached by a root; have a shrub-like growth; consist of a horny, flexible axis or central portion, which is covered by a calcareous cell-crust, like the bark of a tree, and often appear in elegant fan-shaped or flabellated forms. A few fossil species have been discovered in the Upper Chalk of Maestricht and in Tertiary strata.

Goslarite (Goslar in the Harz Mountains).—Sulphate of zinc, consisting of 28.2 oxide of zinc, 27.5 sulphuric acid, and 44.3 water. Generally occurs in old mines and workings as a decomposition from zinc-blende (sulphuret of zinc), and appears in greyish and greenish-white efflorescences, also massive stalactitic, botryoidal, and incrusting.—See WHITE VITRIOL.

Gossan (in Cornish mining).—"A peculiar ferruginous condition," says Ansted, "of the top of a lode near its outcrop, considered to be very strongly indicative of the lode below. Some *gossans* are simply ferruginous quartz, but others are solid iron ore. Gossans are seldom found so deep as 30 fathoms. They not unfrequently have a strong decomposed or ochreous appearance, and sometimes contain gold."

Gower Caves.—The ossiferous caverns of the peninsula of Gower, in Glamorganshire, which have yielded in large abundance the remains of mammoth, tichorine rhinoceros, hippopotamus major, reindeer, and other extinct mammals, associated with species still living in Europe, such as the badger, fox, and wolf, together with flint knives and other rude implements of human workmanship. From the position of these implements, Colonel Wood and the late Dr Falconer, who examined the caverns, consider them to have been unmistakably coeval with the extinct mammals.

Grallatôres (Lat., "walkers on stilts").—The Waders or Stilt-birds; a well-known order of aquatic birds frequenting marshes and shallow waters, and so named from their being raised on their long legs as on stilts. The order comprises the rails, snipes, coots, herons, stilts, cranes, &c.; and is represented in the Tertiary strata by remains having affinity to the curlew, rail, heron, and other grallatorial congeners.

Grammýsia (Gr. *gramme*, a line of writing, and *mys*, a mussel-shell).—A mussel-like bivalve occurring in Upper Silurian strata, and so named

by De Verneuil from the strong transverse lines or furrows which cross its valves from the umbones to the middle of the ventral margin. Regarded as a sub-generic form of the fossil genus *Myacites*.

Granite (Lat. *granum*, a grain).—This well-known rock is so termed from its granular-crystalline composition and aspect. The typical granite is a compound of quartz, felspar, and mica, arranged in distinct grains or crystals; and all rocks partaking of the character and appearance of granite are termed *granitic*. The epithets *granitoid* and *granitiform* are, on the other hand, applied to rocks having some resemblance to granite, though not decidedly of granitic nature, nor even, it may be, of true igneous origin. The granitic rocks, properly so called, are all highly crystalline; none of their crystals are rounded or water-worn; they present no traces of deposition or stratification; they occur in the crust as mountain masses and veins, bursting through and displacing the sedimentary rocks; and they indurate and otherwise alter (as all heated masses do) the strata with which they come in contact. From these circumstances they are held to be of igneous origin; and as far as geologists have been able to discover, they are the most deeply-seated of all rocks—forming, as it were, the floor or foundation for all the superincumbent formations. As the earliest of igneous rocks, they are generally found associated with primary and transition strata, tilting them up on their edges, bursting through them in dykes and veins, and variously altering their positions and mineral character. Though occurring most abundantly among primitive strata, granitic outbursts may be found among rocks of all ages, but certainly not as a marked and general feature of the period—the great epoch of granitic intensity being that which terminated with the deposition of the Silurian strata.

Whether occurring in veins or mountain-masses, the structure of granite is irregular and amorphous. In its texture it varies from a close-grained compact rock to a coarse and loose aggregation of primary crystals. In the composition of granitic rocks there is also considerable variety. Thus, ordinary *granite* is composed of crystals of felspar, quartz, and mica; when the dark glassy mineral called hornblende takes the place of the mica, the rock is known by the name of *syenite* (from Syene in Upper Egypt); and when both mica and hornblende are present, the compound is known as a *syenitic granite*. Occasionally talc supplants the mica, and then the admixture of felspar, quartz, and talc, is known by the name of *protogine* (literally, first-formed)—a term by no means happily chosen, as many of these talcose granites (like those of the Alps) occur in connection with rocks of secondary formation. The term *hypersthenic granite* is applied to an admixture of quartz and hypersthene, with scattered flakes of mica; and *graphic granite* is a binary compound of felspar and quartz—the quartz being disposed through the felspar matrix like the lines of Arabic writing—hence the name. Another fine-grained compound of felspar and quartz, with minute scales of mica, is known by the name of *pegmatite* (*pegma*, compacted); and *porphyritic granite* is the term employed when, in addition to the crystals composing the general mass of the rock, there are indistinctly mingled through it larger and independent crystals of felspar.

Besides the preceding there are other granitic compounds, in all of which felspar, quartz, mica, hornblende, and hypersthene are the principal ingredients, and talc, steatite, chlorite, schorl, and actynolite the

accidental or modifying minerals. It is customary, on this account, to speak of granites as *binary*, *ternary*, and *quaternary*, according to the number of simple minerals that enter into their composition. Thus graphic granite, as composed of felspar and quartz, is a binary; ordinary granite, of felspar, quartz, and mica, is a ternary; and syenitic granite, of felspar, quartz, hornblende, and mica, is a quaternary compound.—(See GRANITELLE, &c.) There are, however, many blendings of these, one into the other; and in the same hill, or even in the same quarry, we may find some half-dozen varieties of granite, if distinctions are to be founded upon the greater or less abundance of any one constituent mineral. However complicated the mineral admixtures of granitic rocks, and however varied their aspects, there are several features which they preserve in common, and which serve to distinguish them from the later igneous rocks. For instance, they are more crystalline, or rather granular-crystalline, than any other variety of igneous rock; they are never vesicular, cellular, or porous, like trap and volcanic lavas; they exhibit less structure than trap-peak rocks, being generally massive or cuboidal, and void of that columnar structure so common in basalts and greenstones; they are never amygdaloidal like traps, conglomerated or brecciated like trap-tuffs, or scoriaceous like volcanic tufa. They seem to have been formed at greater depths or under greater pressure than either traps or lavas; hence they are spoken of as *plutonic*, in contradistinction to *volcanic*, which may be originated under the open air.

Industrially, granitic rocks are of prime importance—the hard and close-grained yielding the most durable building-stone for heavy structures; the soft and decomposable the finest *kaolin*, or china-clay; the veins and vein-stones such accidental minerals as felspar, apatite, mica, meerschaum, asbestos, rock-crystal, tourmaline, beryl, and other precious stones.

Granitelle.—A term employed by Kirwan to designate a binary granite, or granular aggregate of two ingredients. Thus a compound of quartz and felspar is a *granitelle*; of quartz, felspar, and mica, an ordinary or normal *granite*; of any other three ingredients than those constituting granite, as felspar, quartz, and schorl, or quartz, mica, and schorl, a *granitine*; and a compound of more than three ingredients, a *granitite*. The terms are rarely used by modern geologists.

Granitic.—Composed of granite; having some of the characteristics of granite; belonging to the granitic series, which comprehends such rocks as granite proper, graphic granite, syenite, protogine, pegmatite, eurite, and many analogous porphyritic compounds.

Granitoid (Gr. *eidos*, likeness).—Applied to such rocks as have the granular-crystalline aspect of granite. Thus we speak of the “granitoid schists,” meaning thereby such rocks as gneiss, hornblende-schist, porphyritic gneiss, and the like, which have much the aspect of granite without being so in reality.

Granulation (Lat. *granum*, a grain).—The reduction of metals into grains, drops, or coarse powder—generally accomplished by pouring them in the melted state into water.

Graphic Granite (Gr. *grapho*, I write).—Literally “written granite;” a binary compound of felspar and quartz—the quartz being disposed through the felspar matrix like lines of Arabic writing: hence the name.

Graphite (Gr. *grapho*, I write, and *lithos*, stone).—Literally “writing-

stone;" and so called from its use in making writing-pencils. Known also as *plumbago* and *blacklead* from its appearance, though lead does not at all enter into its composition. It consists almost entirely of pure carbon, with a small proportion of iron as an admixture, but not in chemical union—the amount being from 5 to 9 per cent. It occurs chiefly in primary formations, but occasionally in later strata in the neighbourhood of igneous irruptions. When crystallised it appears in six-sided tabular and short prismatic crystals, but generally it is compact and massive, foliated or scaly, and disseminated or occurring in vein-like nests and patches. It is found in many localities—the purest in Britain being that of Borrowdale in Cumberland, where it is included in a bed of trap subordinate to the clay-slate of the district. It is largely used for making writing-pencils, in the fabrication of fire-proof crucibles, as a polishing material, &c.; and has been artificially produced by placing an excess of charcoal in contact with fused cast-iron.—See COAL FAMILY.

Graphulária.—A genus of coralloid organisms, with a horny axis of sub-angular or cylindrical form, occurring in septarian nodules in the London Clay, and by some regarded as an extinct form of *Pennatula*.

Graptolites (Gr. *graptos*, written, and *lithos*, stone).—Characteristic Silurian zoophytes, akin to the virgularia or sea-pen of modern seas; hence the name. They consist of sessile polypse cells, arranged in one or two rows on a flexible stem, and have been subdivided into three groups—1. *Graptolites* proper, or those having a single row of cells united together at the base; 2. *Rastrites*, those having the cells placed—not united, but placed—at wide intervals along the axis; and 3. *Diplograptus*, or those having two rows of united cells arranged along the axis, and presenting a foliaceous appearance. The two first groups seem related to the *Sertularide*, the last to the *Pennatula* and *Virgularia* of the present day. There are also others having twin branches, to which the name *Didymograptus* is applied; and the whole group of these slender serrated fossils is usually distinguished by zoologists as the GRAPTOLITHINA.

Graptopóra (Gr. *grapho*, I write, and *póra*).—A rare form of zoophyte occurring in Lower Silurian rocks, and interesting as showing a probable connection between the Fenestellidæ and Graptolites. It is of horny texture, and appears in leaf-like bundles of fine lines radiating from numerous central pores; hence the name.—See PHYLLOGRAPHSUS.

Grave-Wax.—A familiar term for adipocere, because occasionally found in grave-yards.—See ADIPOCERE.

Gravel.—The familiar as well as technical term for accumulations of water-worn rock-fragments, where the pebbles vary from the size of a pea to that of a hen's egg. It is generally composed of the fragments of the harder and more siliceous rocks—those longest resisting the process of attrition. Accumulations of finer detritus, whose particles are less than a pea, are known as *sands*; those whose fragments are larger than a hen's egg are generally termed *shingle*.

Grávity, Gravitation (Lat. *gravis*, heavy).—The mutual tendency which all bodies in nature have to approach each other, with forces which are directly as their masses and inversely proportional to the squares of their distances. As a force it is altogether independent of the nature of the substances on which it acts, and influences alike the particles of a fragment of rock, and the spheres which constitute the systems of the universe. This mutual tendency of all the particles of matter to each other is called

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the *attraction of gravitation* ; in reference to any particular body, the aggregate attraction of all its particles is usually called simply its *gravity* or *weight*. It is owing to this force that all heavy bodies, when unsupported, fall towards the earth, and that in a direction perpendicular to the level surface of water ; or in other words, in the direction of the plumb-line, which always points towards the centre of the earth—the attraction of a sphere (as demonstrated by Newton) acting in the same manner as if all its matter were condensed into a single point at its centre. The phenomena of gravity, as manifested on and within the earth, is usually spoken of as *terrestrial gravitation* ; that which has reference to the mutual action and reaction of the planetary bodies is denominated *universal gravitation*. Thus the oscillations of the pendulum, and the perpetual tendency of water to fall or seek towards a lower level, depend on terrestrial gravitation ; the bi-diurnal rise and fall of the tides, and the regular revolutions of the planets, are sustained by the force of universal gravitation. Owing to the oblate or spheroidal figure of the earth, which makes the distance between the earth's surface and the centre less by some 13 miles at the poles than at the equator, the gravity of a body slightly increases as we approach either pole. Thus, according to Newton, a body weighing 184 lb. at the equator, would weigh, if transferred to the pole, 195—and proportionally at all intermediate distances ; so that the attraction of gravity becomes not only a measure of weight, but a means of determining the earth's figure, by ascertaining the intensity of gravitation at different latitudes.

Gravity, Specific.—The Specific Gravity of a body is the ratio of its weight to the weight of an equal volume of some other body assumed as a conventional standard. In Britain, the standard usually adopted for *solids* and *liquids* is distilled water at the temperature of 60° Fahr., and for *gases* or *aëriiform bodies*, the ordinary air of the atmosphere. In either case the standard is regarded as unity, or equal to 1. The following list exhibits the specific gravities of some of the more important and abundant rocks, minerals, and metals :—

Agate	2.590	Diamond, Coloured	3.550
Alum	1.714	" Brazilian	3.444
Amber	1.064 to 1.100	Dolomite	2.540 to 2.830
Amethyst, Common	2.750	Emerald	2.600 " 2.770
" Oriental	3.391	Felspar	2.450 " 2.700
Amianthus	0.315 to 1.000	Galena	6.565 " 7.788
Arragonite	2.900	Glass, crown	2.520
Asphalt	0.905 to 1.220	" green	2.642
Azure-stone	2.850	" flint	2.760 to 3.000
Barytes, Sulphate of	4.650	Graphite	1.987 " 2.400
" Carbonate of	4.600	Gypsum, Compact	1.870 " 2.288
Basalt	2.421 to 3.000	" Crystallised	2.311 " 2.900
Beryl	3.549	Heliotrope	2.629 " 3.000
Borax	1.714	Honeystone Mellite	1.650
Calcedony	2.600 to 2.650	Hornblende	3.250 to 3.880
Carnelian	2.615	Hornstone	2.555 " 2.810
Chalk	2.000 to 2.265	Hyacinth	4.000 " 4.780
Chrysolite	3.400	Ironstone	3.000 " 3.575
Coals	1.025 to 1.350	Jasper	2.358 " 2.820
Coral	2.500 " 2.800	Jet	1.300
Corundum	3.710	Limestone	2.386 to 3.000
Diamond, Oriental	3.521	Magnesia, Carbonate	2.240

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Malachite	3.572 to 3.994	METALS, continued—	
Marble	2.500 „ 2.700	Tungstein	17.400
Melanite	3.600 „ 3.800	Uranium	9.000
METALS—		Zinc	6.200 to 7.200
Antimony	6.702	Mica	2.650 „ 2.934
Arsenic	5.765	Mineral Tallow	0.780
Bismuth	9.880	Naphtha	0.700 to 0.840
Brass	7.809 to 8.400	Nitre	1.900
Cadmium	8.600	Obsidian	2.370
Chromium	5.900	Oolite	2.100 to 2.600
Cobalt	8.600	Opal	1.958 „ 2.110
Columbium	5.600	Pearlstone	2.340
Copper	8.900	Pitchstone	2.000 to 2.700
Gold, cast	19.258	Porphyry	2.450 „ 2.950
„ hammered	19.361	Pumice	0.752 „ 0.914
Iridium, „	23.000	Quartz	2.624 „ 3.750
Iron, cast	7.248	Rock-Crystal	2.580 „ 2.888
„ forged	7.788	Ruby, Oriental	4.285
Lead	11.352	Sandstone, Craigleith	2.250
Manganese	8.000	„ Fife	2.100
Mercury	13.598	„ Glasgow	2.156
Molybdenum	8.600	„ Derbyshire	2.628
Nickel, cast	8.279	„ Newcastle	2.229
„ forged	8.666	Sapphire, Oriental	4.200
Osmium-iridium	19.500	Schorl	2.922 to 3.450
Palladium	11.800	Serpentine	2.264 „ 3.000
Platina, forged	20.336	Slate	2.000 „ 2.200
„ wire	21.042	Spar, Fluor	3.090 „ 3.790
„ plate	22.069	„ Calc	2.510 „ 2.830
Potassium	0.865	Sulphur, native	2.033
Rhodium	11.000	„ fused	1.990
Selenium	4.300	Talc	2.000 to 3.000
Silver	10.474	Topaz	4.000 „ 4.066
„ hammered	10.510	Tourmaline	3.000 „ 3.680
Sodium	0.972	Turquoise	2.500 „ 3.000
Steel, soft	7.833	Ultramarine	2.360
Steel, tempered	7.825	Woodstone	2.000 to 2.674
Tellurium	5.700 to 6.110	Zeolite	2.075 „ 2.718
Tin	7.295	Zircon	4.385 „ 4.700

GASES.

Atmospheric Air	1.000	Hydrogen, Sub-carburetted ...	0.555
Carbonic Acid	1.527	„ Sulphuretted	1.180
Chlorine	2.500	Nitrogen	1.041
Hydrogen	0.069	Oxygen	1.111
„ Carburetted	0.972		

Great Oolite.—The “Grand Oolithe” of the French; a frequent synonyme of the Bath Oolite, from the great development of its Oolitic limestones and freestones as compared with other members of the system. It belongs to the lower section of the system—having the Stonesfield slate for its base, and being overlaid by the Forest Marble and Cornbrash.

Green-Earth.—An earthy variety of *chlorite*, occurring in various shades of green, having a greasy feel, and faint lustre when rubbed with the nail. It is common in the trap-rocks, occasionally massive, but more frequently filling amygdaloidal cavities, coating agate nodules, or colouring the sides of fissures, &c., with a thin streaky glaze. The finer varieties furnish the *mountain-green* of the colourman and artist.—See GLAUCONITE.

Greñnockite.—Sulphuret of cadmium; one of the blendes, consisting of 77.3 cadmium, and 22.4 sulphur. It occurs in deep-yellow, hexagonal, translucent crystals with dissimilar terminations in porphyritic amygdaloid, near Bishoptown in Renfrewshire, and is named after its discoverer, Lord Greenock, now Earl Cathcart.

Greensand.—The lower portion of the Cretaceous or Chalk system as developed in the south of England, and so named from its greenish colour, which it owes to a chloritous silicate of iron. These sands, however, are not uniformly green, but partake of ochraceous and yellow tints; present various degrees of fineness, from compact sands to coarse nodular grits; and not unfrequently imbed cherty bands, nodular sandstones, and irregular deposits of fuller's earth, fossil wood, and ochre. In England the greensand is usually divided into Lower and Upper, because of the stiff blue marly clays (gault) which occur about the middle of the group; but otherwise there is a great lithological similarity throughout its entire thickness, which rarely exceeds 400 or 500 feet. The *gault* or *golt* (a local term) is not of great thickness, nor very regular in its occurrence. It is a bluish chalky clay, which effervesces strongly on the application of acids; is interstratified with layers of greensand; and in some localities holds irregular balls of argillaceous ironstone, collected round ammonites and other shells. In some districts the gault assumes a reddish tint, from the iron it contains; but in other respects its composition is very persistent, and it rarely exceeds 80 or 100 feet in thickness. These three members—the Upper Greensand, the Gault, and the Lower Greensand—constitute the *Cenomanien*, the *Aptien*, and *Neocomien* (in part) of French geologists.—See CRETACEOUS SYSTEM.

Greenstone.—A general designation for the hard granular-crystalline varieties of trap, consisting mainly of felspar and hornblende, felspar and augite, or felspar and hypersthene. The term has reference to their greenish or blackish-green colours, and though not very precise, these shades very largely prevail. Compared with the Basalts, the Greenstones (*whinstones* of Scotland) are less compact, more granular, exhibit distinctly their component crystals, often contain sulphuret of iron, and are usually massive or tabular in their structure. It is customary to speak of them as hypersthenic greenstones, augitic greenstones, &c., according to the predominating mineral; and as many of them are porphyritic in their texture, we have *greenstone porphyries*, or *porphyritic greenstones*. Adopting Continental nomenclature, those exclusively composed of hornblende and felspar are termed *diorites*; those of augite and felspar, *dolerites*. On the whole, though the trap-rocks often differ little in composition, the texture of the Greenstone is always more granular or granitic than the basalts, never earthy like the tuffs and wackes, vesicular like the amygdaloids, nor glassy like the obsidians and pitchstones.

Grénatite (Fr. *grenat*, a garnet).—Prismatoidal garnet; known also as *Staurolite* or *Cross-stone*, from the peculiar combination of its prisms.

Gres Bigarré (Fr.)—Literally "variegated sandstone;" the equivalent of the *Bunter Sandstein* of Germany, and the *Variegated Sandstones* or *Lower Trias* of England.

Gres de Vosges.—The lowest member of the Trias or Upper New Red Sandstone of France, as extensively developed in the Vosges.

Greystone.—A variety of trachyte, of a lead-grey or greenish colour, and composed of felspar and augite—the felspar being more than 75 per

cent of the admixture. "Greystone lavas," says Lyell, "are intermediate between basaltic and trachytic lavas."

Greywacké (Ger. *grauwacke*).—A German term originally employed to designate the grey-coloured argillo-arenaceous beds, or coarse slaty strata of the Transition rocks, and subsequently as a name for the entire transition series. It is now seldom employed in this sense—the "transition" rocks having been resolved mainly into the *Silurian*, and partly into the *Cambrian* and *Hypozoic* systems. It is still, however, used to designate the hard, gritty, brecciated, or breccio-conglomerate beds which occur in these formations; and, as a mere lithological term for these *ancient grits* and *breccias*, is by no means without its convenience.

Grey Wethers.—Known also as *Sarsen Stones* and *Druid Stones*; the name given in the south of England to the weather-worn and half-rounded blocks of grey sandstone which are scattered over the surface of the Lower Downs and adjacent districts, and which are evidently the remains of the Eocene sands and sandstones that have been removed by denudation.

Griffithides.—One of the three genera of small trilobites (*Phillipsia*, *Griffithides*, and *Brachymetopus*), the only examples yet discovered in the Carboniferous formation. Named after Sir R. Griffiths, the original expounder of the "Carboniferous slates" of Ireland.

Grit.—Any hard sandstone in which the component grains of quartz are less rounded or "sharper" than in ordinary sandstones, is technically termed a *grit*—as millstone grit, grindstone grit.

Grossular, Grossulaire (Lat. *grossula*, a gooseberry).—The name given by mineralogists to the pale gooseberry-green varieties of translucent lime-alumina garnet.—See GARNET.

Ground Ice.—In northern countries, when the streams are reduced nearly to the freezing-point, congelation begins frequently at the bottom; the reason being, according to Arago, that the current is slowest there, and the gravel and large stones, having parted with much of their heat by radiation, acquire a temperature below the average of the main body of the river. It is therefore when the water is clear, and the sky free from clouds, that ground ice forms most readily, and oftener on pebbly than on muddy bottoms. Sheets of such ice rising occasionally to the surface, bring up with them gravel and even large stones, and in this way become a means of transport where the ordinary current of the stream would be unavailing.

Ground-Swell.—The name given to those long heavy waves which occasionally set in-shore when there is no wind, these having been produced by storms far out at sea. Geologically, the ground-swell is one of the most destructive forms that the wind-wave assumes.

Group.—An assemblage of objects having some resemblance or character in common; hence we speak of groups of strata, of minerals, of plants, and of animals.

Growan.—A mining term for decomposed granite. "The word," says Ansted, "is old Cornish, and appears to have originally meant a rock of uneven composition, whether a conglomerate, a mere gravel, a decomposed porphyritic rock, or solid granite." The expression *soft growan* is sometimes applied when the mineral is sandy.

Gryphæa, Gryphite (Lat. *gryps*, a griffin).—A sub-genus of the Oyster family, abounding in the Lias, Oolite, and Chalk formations. It derives its name from the beak-like incurved umbo of its left or larger valve; the right being small, opercular-like, and concave.

Gryphite Limestone.—A term occasionally applied to the limestones of the Lias, from the marked predominance of the shells of the *gryphæa*.

Guano.—A Peruvian term for the well-known manure obtained from the rocks and islets of the Pacific, and other rainless regions, favourable to the retention of the ammoniacal salts which constitute its principal value. It consists mainly of the droppings of countless sea-fowl, intermingled with their skeletons and eggs, the decomposed bodies and bones of fishes, seals, sea-lions, and other marine creatures frequenting these islands. Considering the immense thickness of some guano deposits (40, 60, and 80 feet), and their necessarily slow accumulation, the lower beds must be of vast antiquity—carrying us back to the very verge of the current era.

Gulf Stream.—One of the most important and influential of ascertained ocean-currents. It is generally considered as "taking its rise in the Gulf of Mexico (whence its name), though it may be regarded as a continuation of the mighty equatorial current, which sets out from the western coast of Africa, and, after a course of four thousand miles, enters the Caribbean Sea. Absorbing the sun's rays as it advances, it passes into that magnificent indentation in the Mexican coast which serves as a caldron; for there its waters are raised to the temperature of 86°. It then sweeps through the Pass of Florida—its heat being 9° more than the ocean can lay claim to, by reason of its latitude—and skirts the shores of North America, until it takes that remarkable bend off Nova Scotia and Newfoundland, which throws its waters towards the coasts of Europe. One branch curves downwards and flits past the Azores to the south; the other glides northward in the direction of the British Islands and the Polar Sea. This magnificent ocean-river is supposed to be equal in volume to three thousand Mississippis. Its length, reckoning from its Mexican head to the Azores, is upwards of three thousand miles. Its velocity in the Gulf of Florida is about 78 miles a-day, but its current dwindles down to a sober flow of 10 before it reaches the Azores. Its average velocity is about 38 miles in the four-and-twenty hours. There are many peculiarities attached to this noble current. The colour of its waters is an indigo-blue as far as the coast of the Carolinas. Its margins, especially the left, are generally well-defined; so that the voyager knows when he dips into its flood—the edge being made manifest by the ripples which mark the line of division, as well as by other visible traits. It would appear, too, that this current actually runs up-hill, for the thermometer shows that the under part, in flowing from Cape Hatteras to the Capes of Virginia, makes an ascent of six hundred feet, being a gradient of five or six feet to the mile. It is noticeable, also, that the surface of this ocean-river slopes from the centre towards the margins, like the curve of a causeway, and thus boats and other objects, if left to themselves, naturally drift towards the edges. It is in this way that the Sargasso Sea (the expanse permanently covered with the *fucus natans*) has been formed—the weeds, like the drift on an eddy, floating always towards the still and lower level."

The great function of the Gulf Stream seems to be the equalisation of the superficial temperature of the globe. Acquiring in its fountain-head a temperature of 86°, and losing only some 13° or 14° in its progress, it diffuses a perennial supply of warmth, not only among the waters of the oceans, but throughout the atmosphere which passes over it, and over the countries along whose shores it travels. Thus, as its velocity slackens

about mid Atlantic, it begins to diffuse itself over a wider area, and so counteracts the cold brought down by the Arctic Current. So perceptible is this, that while the sea beyond its influence is little above freezing, navigators, on fairly entering its waters, find the ocean gradually rise to 50° above freezing. As it diffuses itself, in virtue of its diminished velocity, it spreads over a wider area, and thus renders more genial a broader expanse of ocean; while the winds passing over it are tempered, and bear their balmy influences to wider regions. It is to the Gulf Stream that western Europe, and Britain in particular, owes a higher mean temperature than other places in the same parallels of latitude; and so, also, while modifying the rigours of our European winters, it sends its surplus warmth to Arctic regions and the Polar seas. Cosmically, it is thus a great modifier and regulator of the Life of the ocean, as well as of the countries against which its genial current impinges—conferring on regions which are geographically sub-temperate, a truly temperate flora and fauna. Geologically, it gives us vast insight into those modifications of former climate which may have been brought about by other distributions of land and sea than those at present existing, and that without at all calling in the aid of those abnormal conditions of “internal heat,” “change of earth’s axis,” and the like, under which the slenderly informed theorist too often takes shelter.—See Maury’s ‘Physical Geography of the Ocean.’

Gum-Lead.—The familiar term for *plumbo-resinite* (which see), from its appearance to gum-arabic.

Gurt (Sax.)—In mining, a gutter or channel for water, usually hewn out of the “pavement” or bottom of a working drift.

Guyaquilite.—A mineral resin occurring in friable amorphous masses of a pale-yellow colour, and melting at 157° Fahrenheit. It is found at Guyaquil in South America, on the site of ancient resiniferous forests, and, like amber, is evidently of vegetable origin.—See MINERAL RESINS.

Gymnodonts (Gr. *gymnos*, naked, and *odontos*, tooth).—A family of fishes belonging to the order *Plectognathi* (soldered jaws), and including the globe-fish, trunk-fish, &c., in which the jaws are covered with a substance resembling ivory arranged in small plates, representing united teeth. The *gymnodonts* appear only in the Chalk and Tertiary formations.

Gymnosperms (Gr. *gymnos*, naked, and *sperma*, seed).—Flowering plants with naked seeds (that is, whose ovules are not enclosed in a pericarp), and so called in contradistinction to the *Angiosperms*, whose seeds are enclosed. The gymnosperms, or *gymnogens*, as they are also termed, differ only in this respect from the *Exogens*, and consequently have their wood arranged in concentric layers; e.g., the *Coniferæ* or Pine tribe.

Gypseous.—Resembling or partaking of the nature of gypsum, as “gypseous marls.” **Gypsiferous.**—Containing or producing gypsum, as “gypsiferous limestones.”

Gypsum.—Sulphate of lime, plaster-of-Paris, or stucco-stone. The Greek word *gypsos* signifies lime in general, and seems to be derived from *ge*, the earth, and *epso*, I boil, in allusion to the heat given off when burnt lime is slacked with water. Gypsum is found in *crystals*, in *fibrous* masses, and in *granular-compact* beds, often of great extent. Its normal composition is 46.47 sulphuric acid, 32.65 lime, and 20.88 water. “It is a very common mineral,” says Nicol, “especially in the more recent sedimentary formations, and is even now forming, either as a deposit from water holding it in solution, or from the decomposition of iron-pyrites, when the sulphuric

acid combines with lime, or from the action of sulphurous vapours in volcanic regions on calcareous rocks. It is often imbedded in nests or reniform masses in clay or marl, more rarely makes part of mineral veins, but seldom or never forms veins by itself. The transparent crystals are termed *selenite*, and fine specimens occur in the salt mines of Bex in Switzerland, in those of the Tyrol, Salzburg, and Bohemia, in the sulphur mines of Sicily, at Lockport in New York, and other places in North America, in the clay of Shotover Hill near Oxford, at Chatley near Bath, and many other localities. Fibrous gypsum (*satin-spar*) occurs of remarkable beauty at Ilfeld in the Harz, in the compact gypsum of northern Germany, and at Matlock in Derbyshire. Compact white gypsum or *alabaster* is found in great beauty at Volterra in Tuscany, and also in the Harz. Massive or compact gypsum forms whole beds in the Trias and Permian Red Sandstones of many parts of Germany, France, Italy, and England, and is often associated with rock-salt. In Nova Scotia it occurs with similar beds in the Lower Carboniferous formations. The fine varieties are cut into various ornamental articles, as vases, and the so-called *Roman pearls*, chiefly distinguished from the true pearl by their specific gravity. Plaster-of-Paris, used for casts and other works of art, is formed by calcining the mineral and grinding it down to a fine powder, which forms a paste that soon hardens by absorbing the water driven off by the heat. It, however, loses this property when exposed to a temperature above 300° Fahrenheit, when it becomes similar to *Anhydrite*. Gypsum is also used for glazing porcelain, and the formation of potters' moulds; in the manufacture of glass; as mortar, and as manure, especially as a top-dressing for meadows."

Gyracanthus (Gr. *gyros*, a circle or spire, and *acantha*, a spine).—Literally "spiral or twisted spine;" a genus of ostracodont fin-spines or ichthyodolulites occurring in the Carboniferous and Permian formations, often from ten to eighteen inches in length, and so termed from the sculptured ridges with which they are ornamented, and which run in a spiral or twisted-like manner, from the base upwards.

Gyration (Gr. *gyros*, a circle).—The act of revolving; a revolution. **Gyratory**.—Having a revolving and twisting motion.

Gyrodus (Gr. *gyros*, a circle, and *odous*, tooth).—Literally "circle tooth;" a genus of pycnodont fishes, occurring in the Oolite and Chalk, and so termed from their circular grinding teeth, which are disposed in rows on the bones composing the roof, floor, and sides of the mouth. The fishes of this genus have the body large, flat, and elevated; the dorsal and anal fins long; the tail forked with unequal lobes; and the scales laterally connected by strong processes, as in *Lepidotus*.

Gyrogonites (Gr. *gyros*, twisted, and *gone*, seed).—The spiral seed-vessels of plants allied to the chara, and found fossil in fresh-water Tertiaries. "The Chara," says Lyell, "inhabit the bottom of lakes and ponds, and flourish mostly where the water is charged with carbonate of lime. Their seed-vessels are covered with a very tough integument, capable of resisting decomposition, to which circumstance we may attribute their abundance in a fossil state."

Gyrolite (Gr. *gyros*, a circle, and *lithos*, stone).—A hydrous silicate of alumina occurring in spherical lamellar radiations within the cavities of basalt and greenstone. White and vitreous when fresh, but becomes pearly on exposure to the air.

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Haarkies (Ger. *haar*, hair).—A German term for the native sulphate of nickel, or *Millerite*, which occurs in very fine acicular and capillary crystals. It is known also as *Capillary Pyrites*, and consists of 64.76 nickel and 35.24 sulphur.

Habitat.—Applied in botany and zoology to the country or district in which a plant or animal is indigenous; the tract or range to which it seems limited by external conditions of soil, climate, &c. More properly, the term *station* is applied to plants, and *habitat* to animals.

Hackly.—Having the surface rough with irregular protruding points; a term applied to the fracture of rocks and minerals when they break up with a rough irregular surface, as certain greenstones and granites.

Hade, Hading.—A miner's term for the inclination or slope of any slip, fault, vein, or lode. The amount of deviation from the vertical is spoken of as the *hading*; and a fault or vein so sloping is said to *hade*.

Hadrosaurus (Gr. *hadros*, mighty, and *sauros*, lizard).—The name given by Dr Leidy of Philadelphia to a huge herbivorous reptile whose remains were discovered, in 1858, in the Chalk marls of Haddenfield, New Jersey. The remains comprised nearly the entire skeleton, and gave ample indication of a genus closely allied to, but larger than the *Iguanodon* of the English Weald. Dr Leidy thinks the creature was most probably amphibious; and, from the greatly disproportioned size of the fore and back parts of the skeleton, suspects that it may have been in the habit of browsing, kangaroo-like, in an erect position, sustaining itself on the hinder extremities and tail; or if it retained the ordinary prostrate condition, it must have progressed in the manner of the batrachians. Calculating from the remains now preserved, the *Hadrosaurus* must have been about 25 feet in length, from snout to tail, and in height from 9 to 10 feet upon the haunches.

Hæmatite, Hématite (Gr. *haima*, blood).—Native oxide of iron, so named from its prevailing reddish colour and blood-like streak. It is customary to speak of the *red hæmatite* and the *brown hæmatite*—the one being an anhydrous (70 iron, 30 oxygen), the other a hydrated peroxide of iron (85.6 peroxide of iron, and 14.4 water). The red hæmatite is an abundant ore, occurring in veins and beds in the older crystalline rocks, and passing from a state of sparry crystallisation (*specular iron*), through concentric kidney-shaped concretions (*fibrous red iron*), and compact or ochrey masses (*hæmatite proper*), to a soft earthy variety known as *reddle* or red-chalk. The brown hæmatite, often termed *Limonite*, occurs in beds, veins, and nests, in rocks of all ages, and also presents several varieties, as the *fibrous*, *compact*, and *ochrey*. It is frequently mixed with other mineral substances, such admixtures forming *umber*, *yellow-ochre*, *bog-iron*, and other well-known substances.—See IRON.

Hæmatocorya (Gr. *haima*, blood, and *kryos*, cold).—Literally "cold-blooded;" a term applied by Professor Owen to the cold-blooded vertebrates (fishes and reptiles), in contradistinction from the *Hæmatotherma*

or warm-blooded birds and mammals. Considering the linking and blending of the fishes with the reptiles, he regards the *Hematoecrya* as a wider group possessed of great naturalness of character.

Hematothérma (Gr. *haima*, blood, and *thermos*, heat).—Literally "warm-blooded;" a term applied by Professor Owen to the warm-blooded vertebrates (birds and mammals), in contradistinction from the *Hematoecrya* or cold-blooded fishes and reptiles.

Haidingerite (after Haidinger, the mineralogist).—A name given to two totally different minerals—the Haidingerite of Turner being a hydrous arseniate of lime (85.68 arseniate of lime, and 14.32 water); and that of Berthier being an ore of antimony, consisting of sulphuret of antimony and sulphuret of iron in varying proportions.

Hail (Sax., so called from the rough, broken form of the hailstones).—Rain or other moisture that has been suddenly frozen in its downward course by passing through a stratum of air below the temperature of 32°. Hail pellets are of various forms—round, angular, or flat; and though generally about a quarter of an inch in diameter, have yet been found two and three inches in diameter, especially during thunder-storms and in tropical countries. The phenomena attending the formation and fall of hail are not well understood, though sudden cold winds seem to be the chief promoters. The electricity usually accompanying hail-storms is an effect rather than a cause—the electric fluid being an accompaniment of the passage of water from a liquid to a solid state.

Hair-Salt.—A familiar term for native sulphate of magnesia, from its frequent occurrence as a fine capillary incrustation on the walls of damp cellars and new buildings.

Halcyónis (Gr. *halcyon*, the kingfisher, and *ornis*, bird).—An extinct bird, whose remains occur in the Eocene beds of the Isle of Sheppey; and so termed from its apparent affinities to the existing kingfisher.

Halecopsis (Gr.).—Literally "herring or sprat-like;" a genus of fishes founded by Agassiz on some remains from the London Clay of the Isle of Sheppey, and so named from their fusiform, sprat-like appearance.

Halithérion (Gr. *hals*, *halos*, the sea, and *therion*, beast).—Literally "sea-beast;" a Tertiary cetacean having evident affinities to the phytophagous family of the *Manatidae* or sea-cows.

Halogene (Gr. *hals*, salt, and *gennao*, I produce).—A term employed by Berzelius to denote bodies which form salts with metals, as chlorine, bromine, iodine, fluorine, and cyanogen. The salts thus produced are termed *haloids*.

Haloid Salts (Gr. *hals*, salt, and *eidos*, resemblance).—Salt-like compounds consisting of a metal on the one hand, and of chlorine, iodine, and the radicals of the hydracids in general, excepting sulphur, on the other.

Halónia.—A genus of fossil stems apparently intermediate between the Lycopods and Conifers, and so called from its affinity, being nearest with *Halonía*. "It comprehends," according to Lindley, "all stems in which, to the surface of lepidodendron, is added the mode of branching of certain conifers." According to others, *Halonía* is merely the branches of *Knorria*, and is described as "stem not furrowed, branched, covered with indistinct rhomboidal marks, and tubercular projections disposed in quincunx order."

Halysites (Gr. *halusis*, a chain).—Chain-pore coral; a genus peculiar to Palæozoic strata, and better known as *Catenipora*, which see.

Hamite (Lat. *hamus*, a hook).—A genus of the Ammonite family peculiar

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to the Chalk and Greensand, and so named from the shell, which is hook-shaped, or bent upon itself more than once—the courses being separate. D'Orbigny separates the Greensand from the Chalk species, and erects them into a distinct genus under the title *Hamulina*.

Hardness of Minerals and Rocks.—In discriminating rocks and minerals, their *hardness* is one of the physical properties almost invariably made use of by the geologist and mineralogist. In mineralogy, it is estimated by a conventional scale of ten degrees, invented by Mohs, who assumed talc to be the lowest in the scale, and diamond the highest, thus:—

Talc,	1	Adularia felspar,	6
Rock-salt,	2	Rock-crystal,	7
Calc-spar,	3	Topaz,	8
Fluor-spar,	4	Corundum,	9
Apatite,	5	Diamond,	10

If, for example, a mineral can be scratched by rock-crystal, but can in turn scratch felspar, it is evident its hardness lies between 6 and 7 of the scale, and may be expressed by 6.3 or 6.8, just as it seems to approach felspar on the one hand, or rock-crystal on the other. The hardness of minerals may also be tested by the application of a file or steel point; and thus it is customary to say that talc can be scratched with the nail of the finger, that felspar yields to the knife, while rock-crystal resists it. In treating of rocks it is impossible to determine their hardness with the same precision, though quartz-rock may be regarded as standing at one end of the scale, and ordinary white chalk at the other. A very good test of the hardness and compactness of a rock is the sound that it emits when struck by the hammer—the harder yielding a sharp ringing sound, the softer a dull and heavy. It is thus that the French quarrymen estimate the quality of the celebrated Caen stone, their scale of hardness being indicated by the expressive sounds *pif, paf, pouf*—the *pif* being the hard and compact, the *pouf* the soft and friable.

Hare.—Remains of the hare and rabbit have not yet been detected in deposits of older date than the Pleistocene bone-caverns of England and the south of Europe.

Hármátome (Gr. *harmos*, a joint, and *tome*, a section).—One of the Zeolite family, consisting of 48.3 silica, 17.8 alumina, 19.9 baryta, and 14 water, with traces of lime and potash. It is known also as *Cross-stone*, and derives its name from the joint-like intersection of its rhombic crystals. Associated with zeolite, &c., in the older metalliferous veins.

Harmáttan.—The name given in Guinea and Senegambia to the *simoom* or hot dry wind which blows from the great African desert during the months of December, January, and February.—See *SIMOOM*.

Hartite.—A fossil resin occurring in the brown coal of Oberhart, in Lower Austria, either in transparent clearable masses, in angular fragments, or in small tables with six faces. Resembles wax in appearance; colourless or greyish white, with a somewhat greasy lustre; translucent; brittle; melts at 165° Fahr., and consists of 87.5 carbon, 12.05 hydrogen.

Háthetine (after Mr Hatchett, the mineralogist).—Mineral tallow; a waxy or spermaceti-like substance of a greenish-yellow colour, faint pearly lustre, and translucent. Occurs in thin flaky veins in the ironstone of Merthyr-Tydvil and other localities; consists of 86 carbon and 14 hydrogen; and is fusible, according to variety, at 115° to 160° Fahr.—See **RESINS, MINERAL.**

Hausmannite (after the mineralogist Hausmann).—Pyramidal manganese ore, occurring, with other manganese ores, either as a protoxide or as a peroxide of that metal.

Haüyne (after the mineralogist Haüy).—One of the Haloid minerals, of a fine azure-blue colour, and occurring in crystalline grains, in lava and other volcanic rocks. Its average composition seems to be 34.8 silica, 23.9 alumina, 17.2 soda, 7.9 lime, and 11.2 sulphuric acid.

Hayesine (after Hayes).—Borate of lime, occurring in globular, mammillated or reniform masses, from the size of a marble to that of a potato, on the dry plains of Iquique in Peru; in incrustations near the lagoons of Tuscany; and in narrow veins in gypsum in Nova Scotia. On being broken the masses present the appearance of interwoven silky fibres of a snow-white colour; are opaque, tasteless, but with a peculiar odour, and consist of 52 boracic acid, 11.5 lime, and 35 water, with traces of soda, sulphuric acid, and chlorine. Imported from Peru under the name of *Tiza*, which see.

Heading.—In mining, a small gallery driven in advance of a gate-road or larger gallery; or, it may be, driven for some temporary purpose.

Headland.—Any projection of the land into the sea; generally applied to a *cape*, *ness*, or *promontory*, of some boldness and elevation.

Heart-wood.—A familiar term for the hard and matured interior portion of exogenous stems or timber-trees, in contradistinction to the *sap-wood*, or soft, unmaturred, exterior layers. Technically, the former is termed *duramen*, the latter *alburnum*.

Heave (in mining).—The displacement of a vein or bed by the intersection of another vein or fault. When the intersected vein is thrown up, it is said to be a *heave*, and when thrown down a *slide*. Heave and slide are thus merely relative terms, according to the position from which they are viewed.—See FAULT and DISLOCATION.

Heavy-Spar.—A term often loosely applied to the carbonate as well as to the sulphate of baryta, and not unfrequently also to the carbonate and sulphate of strontia. Properly speaking, the "heavy-spar" of the mineralogist is the sulphate of baryta, occurring in veins massive, fibrous, lamellar, and in prismatic crystals. The rhomboidal carbonate is better known as *Witherite*, the carbonate of strontia as *Strontianite*, and the sulphate of strontia as *Celestine*—all of which see.

Hedenbérghite.—An important variety of lime-iron augite, of a black or blackish-green colour, named after Hedenberg, the Swedish chemist.

Helianthoida (Gr. *helios*, the sun, and *anthos*, flower).—Literally "sun-flowers;" the actiniform zoophytes, which constitute an extensive order of the Anthozoa, and of which the *actinia* or sea-anemones may be taken as the type. The Helianthoids, except in the free species, as the *Actinia*, have a lamellated calcareous polypidom, the plates of which radiate (flower-like) from the centre; and these stony structures enter largely into the composition of coral-reefs, recent as well as fossil.

Helicidae (Lat. *helix*, a coil).—The land-snails; a well-known family of vegetable-eating gasteropods, having a light, variously coloured, more or less turbinated shell, and of which the garden-snail may be taken as the type. The Helicidae, of which there are upwards of 1200 living species, have a world-wide range; the extinct species, about 50 in number, are found only in Tertiary and recent formations.

Helloceras, **Hellocératite** (Gr. *helix*, a spiral, and *keras*, horn).—A genus

of the Ammonite family, ranging from the inferior Oolite to the Chalk inclusive, and so named from the spiral arrangement of its chambered whorls.

Heliolites (Gr. *helios*, the sun, and *lithos*, stone).—An extensive genus of Silurian and Devonian corals, belonging to the family *Milleporidae*; and so called from the central-radiating or sun-like aspect of the septa of their pores, compared with those of the *Astræa* or star-corals.

Heliotrope (Gr. *helios*, the sun, and *trope*, turning).—Bloodstone; a variety of calcedony of a dark-green colour, and sprinkled with deep red spots. The name is also applied by lapidaries to stones, some of which are agates and others jaspers—the *agate-bloodstones* being in greater part translucent, the *jasper-bloodstones*, on the contrary, being mainly opaque.

Helminthites (Gr. *helminthos*, a worm).—Applied to those long sinuous tracks so common on the surfaces of many flaggy sandstones, and which are usually considered as worm-trails.

Hélotus (Gr. *helos*, a stud, and *odus*, tooth).—Literally “stud-tooth;” a genus of cestraciont fish-teeth, occurring abundantly in the Carboniferous Limestone, and so termed from the stud-like aspect of their crushing crowns.

Helladothérium (Gr. *Hellas*, Greece, and *therion*).—An extinct pachyderm of Upper Tertiary, or perhaps Miocene, age, from the Pikermi beds at the foot of Mount Pentelicus, in Greece; whence the name.

Hematite, more frequently **HÆMATITE**, which see.

Hemi.—A Greek word frequently employed as a prefix to denote *half*, and synonymous with the Latin *semi*; as *hemisphere*, half a sphere; *hemiptera*, half-winged, &c.

Hemicidaris (Gr. *hemi*, half, and *cidaris*).—A genus of turban-echinites characteristic of the Upper Jura Limestone of Switzerland, and distinguished by its depressed form (*hemi*), and long sub-cylindrical spines. It occurs abundantly in the Oolites of England.

Hemicosmites (Gr.)—Literally “half-sphere.” A Lower Silurian cystidean, characterised by its spherical form, composed of numerous hexagonal and pentagonal plates; central, proboscoidiform mouth; and absence of tentacles or arms. Originally known as *Echinosphærites*.

Hemipneustis (Gr. *hemi*, half, and *pneustis*, blown).—M. Agassiz's generic term for the fossil sea-urchin *Spatangus*, in allusion to its *flattened* or *half-inflated* shape.—See SPATANGIDÆ.

Hemipristis (Gr. *pristis*, a saw).—A provisional genus of shark's teeth occurring in the Chalk and Tertiary formations. They are distinguished by their serrated edges, that do not extend to the summit, which is sharply pointed.

Hemitelites (Gr. *hemiteles*, half-finished, incomplete).—A term employed by Göppert to designate certain Oolitic ferns, because of their abruptly terminating (incomplete-looking) pinnules. The *Phlebopteris* of Professor Lindley, which see.

Hepatic (Gr. *hepar*, the liver).—Applied in mineralogy to various substances of a *liver-like* colour and consistency; as *Hepatic pyrites*, a variety of prismatic iron pyrites which, on exposure to the atmosphere, is gradually converted from a yellow sulphuret to a liver-brown compact oxide of iron, still retaining the original crystallised form; *Hepatic cinnabar*, a variety of cinnabar of a dark liver colour, passing into steel-grey.

Hépatite (Gr. *hepar*, the liver).—A dark-grey variety of heavy-spar or sulphate of baryta, which, when rubbed, emits a fetid odour like sulphuretted hydrogen. It seems a mere mixture of barytes with carbonaceous matter.

Herbaceous.—Applied in botany to stems that die down annually, in contradistinction to *ligneous*, or woody, persistent stems.

Herbivorous (Lat. *herba*, herb, and *voro*, I devour).—Herb-eating; subsisting on vegetable food; in contradistinction to *carnivorous*.

Hermétically Sealed.—Sealing or closing-up by fusion, as the closing of a glass tube by melting the ends. Said to be derived from the Egyptian Hermes, the fabled father of chemistry.

Herpetichnus (Gr. *herpeton*, a reptile, and *ichnos*, footprint).—A provisional term employed by Sir W. Jardine for certain small lizard-like footsteps occurring on the New Red Sandstone alabs of Corncockle Muir, Dumfriesshire, of Storeton, Cheshire, and similar localities.

Herpetology (Gr. *herpeton*, reptile, and *logos*, discourse).—That branch of zoology which treats of the structure, habits, history, and arrangement of reptiles.

Hervidéro (Span. *hervir*, to boil).—The name given in Central America to the mud-volcanoes which occur in that and the contiguous districts of Mexico. The *hervideros* consist of mounds more or less conical, with a crater at top, in which a clayey fetid mud of various colours and consistency is kept in continual ebullition, and which is occasionally thrown up in pasty flakes that fall around and form the conical mounds in question. The vapours that escape from these hervideros are chiefly steam, sulphuretted hydrogen, and sulphuric acid; and in the fetid mud, as it cools and hardens, are detected numerous incipient cubes of iron-pyrites and flakes of selenite or crystallised gypsum.

Hetero (Gr. *heteros*, the other, not the same).—A term often employed in composition to denote difference or dissimilarity, as *homo* indicates sameness or similarity. Thus *heterogeneous*, composed of different materials; *heterocercal*, having unequal lobes, like the tail of the dog-fish, &c.

Heterocercal (Gr. *heteros*, other, not the same, and *kerkos*, tail).—A term applied by Agassiz to fishes having unequally-lobed tails, that is, where the rays are principally developed on the under side, and the vertebrae are produced far beyond, forming an upper and prominent lobe, as in the sharks and dog-fishes. Existing fishes have chiefly *homocercal*, or equally-lobed tails, as the herring, cod, salmon, &c.; several have undivided or *single* and rounded tails, as the wrasse; while the unequally-lobed or *heterocercal* tail is found only in the sharks, sturgeons, lepidosteus, and a few others. In the Palaeozoic periods, however, the heterocercal form alone prevailed, no fish with a true homocercal tail occurring below the Triassic formation.

Heteroclit (Gr. *heteros*, other, not alike, and *klytos*, notable).—Irregular; notably diverse; dissimilar in parts. Thus Cuvier designates the Plesiosaurus as the most *heteroclit* animal—that is, made of the most unexpected combination of parts—that had come under his knowledge. To the head of a lizard it united the teeth of a crocodile; a neck of enormous length, resembling the body of a serpent; the trunk and tail having the proportions of an ordinary quadruped; the ribs resembling those of a chameleon; and the paddles being like those of the whale.

Heulandite (after Mr Heuland, the English mineralogist).—Foliated or

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tabular zeolite; the *Stilbite* of Italy. Occurs chiefly in amygdaloid and other trap rocks; is generally white, but often of reddish or hair-brown colour; and consists of 58.1 silica, 18.4 alumina, 7.5 lime, and 16 water.

Hexagon (Gr. *hex*, six, and *gonia*, an angle).—A figure with six angles, and consequently having six sides.

Hexagonal (Gr. *hex*, six, and *gonia*, an angle).—Applied to figures having six angles, and consequently six sides, more or less regular. Basalt occasionally appears in *hexagonal* or six-sided columns.

Hexaprotodon (Gr.)—Literally "six-front-teeth;" the generic term for a large pachyderm whose remains occur in the Pliocene and Miocene Tertiaries of Asia. It was, according to Owen, "essentially a hippopotamus, with six incisor teeth, instead of *four*, in each jaw."

Highgate Resin.—A familiar term for a species of fossil gum-resin or copal found in nodular masses in the Tertiary Clay at Highgate, near London.

High-Level Gravels.—A recent designation for those sands and gravels, consisting largely of rolled chalk-flints, which cover so much of the higher grounds in the south of England and north of France. It is believed that this deposit was spread over the surface before the formation of the existing valleys. No fossils have been found in the high-level gravels, and Mr Godwin Austen supposes that they may be of any age between that of the uppermost Eocenes and the Crag.

Hills-Conglomerat, Hills-Thon.—In Germany and Brunswick respectively, the equivalents of the Lower Greensand of England.—See tabulations, "GEOLOGICAL SCHEME."

Hippopodium (Gr. *hippos*, horse; *pous, podos*, foot).—Literally "horse-foot;" a large heavy bivalve, allied to Cypriocardia, and characteristic of the Lower Lias shales of England.

Hippopotamus (Gr. *hippos*, horse, and *potamos*, river).—A well-known amphibious pachyderm, now restricted to the rivers and swampy lakes of Africa, but whose remains are found abundantly in the Pleistocene or uppermost Tertiaries of England, France, Germany, and Italy. These remains, which occur in Pliocene, Pleistocene, and Recent deposits, seem to indicate the existence of several species, and some of these of more gigantic dimensions than the living animal.

Hippotherium (Gr. *hippos*, horse, and *therion*, wild beast).—A mammal of the Miocene Tertiaries, so called from its close resemblance to the Horse family. Remains from the Siwalik Hills indicated a size about that of the fallow-deer, with extreme length and slenderness of limb.

Hippurite (Gr. *hippos*, horse).—A massive horsehoof-like bivalve of the Chalk formation, having a deep conical or sub-cylindrical under-valve, with a flattish lid or upper-valve. As a family the *Hippuritidæ* have no living analogues; hence the diversity of opinion that has been expressed as to their true relations. The family embraces the *hippurites*, *radiolites*, *caprinella*, *caprina*, *caprotina*, &c.—all very peculiar in form, and highly characteristic of the Lower Chalk both in Europe, Northern Africa, and America; hence the occasional Continental term of the "Hippurite limestone" for the calcareous beds of that formation. For the structure and affinities of the *Hippuritidæ*, see S. P. Woodward in the 11th vol. of the 'Geological Journal.'

Hippurites.—A genus of Coal-measure plants, so called from their close resemblance to the common *hippuris vulgaris*, or mare's-tail of our marshes. If they grew in the same relative proportions as the existing hippuris,

many of the fragments found would indicate a height of eighteen or twenty feet. Very little, however, is known of their habits or true affinities.

Histology (Gr. *histos*, a tissue, and *logos*, a discourse).—The doctrine of the tissues which enter into the formation of the various organs of any living being; that department of natural science which is specially connected with the investigation (by the microscope) of the minuter structures of organic life.

Hog's Backs.—The name given by geologists to the ridgy structure of certain districts, which consists of alternate ridges and ravines, occasioned either by the sharp undulations of the subjacent rocks, or more frequently by the erosive action of mountain-torrents that cut out the ravines and leave the ridges or "hog's backs" standing between. This structure occurs most abundantly on the lower slopes and flanks of mountain-ranges.

Holaster (Gr. *holos*, entire, and *astron*, star).—A genus of Spatangidae (which see) established by Agassiz for those echinites that are heart-shaped, with simple ambulacra converging towards the summit. The mouth is elongated transversely, and the vent is on the posterior face. The species are common in the Lower Chalk and Chalk-marl of England.

Holæctypus (Gr. *holos*, entire, wholly, and *ektypos*, moulded or embossed).—"In certain kinds of *Galerites* (fossil sea-urchins) the shell is strengthened internally," says Mantell, "by five strong ribs or projections, which of course leave corresponding deep furrows or channels on the flint casts moulded in them;" hence the name. These echinites have been erected by M. Desor into the genus *Holæctypus*, the characteristics of which are—shell hemispherical and circular; the base flat; the tubercles disposed in series; the inside of the case supported by five lamellæ or ribs.

Holing.—In coal-mining, cutting under a seam of coal for a certain distance, so as to deprive it of support, and thus facilitate its falling down when cut away at the sides of the gallery or when wedges are driven in at the roof. This "holing," which is one of the most laborious parts of coal-mining (inasmuch as it is frequently performed by the miner lying on his side), has been recently performed by an under-cutting machine, propelled by compressed air, and which, from its rapidity and greater depth of stroke, bids fair to come into very general operation.

Holopæa (Gr. *holos*, entire, and *ope*, opening).—Literally, "entire-mouth;" an obscure genus of Lower Silurian Gasteropods; periwinkle-like in contour, and hence formerly regarded as a form of *Littorina*. Outer lip situated near the base.

Holopælla.—Another obscure genus of Silurian Gasteropods; *turritella*-like in form, and hence originally ranked under that genus. Peristome entire, not produced in front.

Holoptychius (Gr. *holos*, entire, and *ptyche*, wrinkle).—Literally "all-wrinkle;" a genus of sauroid fishes belonging to the Devonian and Carboniferous periods, and so called from the corrugated or wrinkled surfaces of their enamelled scales. They belong to the *Celacanthi* or hollow-spines; and judging from the bones of the head and the dorsal and fulcral scales, which are often from three to five inches in width, many of them must have been of great size—from eight to ten or even twelve feet in length. In some species the wrinkles or furrows on the scales are disposed in labyrinthine fashion; in others they radiate in dichotomising lines from the anterior to the posterior margin; and in others, again, they are arranged in

somewhat concentric order. Besides being armed with numerous sharp-pointed fish-teeth, their jaws were furnished with larger reptilian teeth of conical form placed at intervals in either jaw, evidently for the purpose of seizing and cutting up their bulkier prey. In the Carboniferous genus *Rhizodus*, which has been separated from the *Holoptychii*, the teeth are larger, compressed laterally, and more trenchant in form, while the scales also are larger and stronger, and covered with irregular granular corrugations. As yet the chief localities for *Holoptychius* have been the middle and upper Devonian sandstones of Elgin, of the Carse of Gowrie, and of Dura Den in Fife; and the lower Carboniferous strata of Fife, Mid-Lothian, and Lanark in Scotland, and of Armagh in Ireland. Though remains are abundant enough, much yet remains to be done for the rigid determination of the so-called species.

Holothurióidea.—The sea-cucumbers; an order of echinoderms, of which the common *Holothuria*, or sea-cucumber of our own shores, has been taken as the type. They are characterised by their vermiform body, which is covered by a tough flexible integument with scattered reticulate calcareous corpuscles, or beset with minute anchor-shaped spicula. Portions of the imbricated integument of one genus (*Psolus*) have been found in the glacial clays of Bute; and the spicula of others occur fossil so early as the Chalk and Oolite.

Homalonótus (Gr. *homalos*, on the same level or plane, and *notos*, the back).—A genus of trilobites occurring in Silurian and Devonian strata, and so termed because the three-lobed aspect so characteristic of the family is in a great measure obliterated, and the back appears smooth and uniform.

Homo- (Gr. *homos*, one and the same).—A term often employed in composition to denote similarity or sameness, as *hetero* indicates difference or dissimilarity. Thus, *homogeneous*, consisting of similar parts or properties; *homologous*, having the same ratio or proportion.

Homocércal (Gr. *homos*, alike, and *kerkos*, tail).—A term applied by Agassiz to those fishes which have equally-bilobate tails, as the herring, cod, salmon, &c., in contradistinction to those that are unequally lobed or *heterocercal*, like the sharks and sturgeons. In geological formations, the homocercal tail is not known till the Oolitic period—all the palæozoic fishes being heterocerques.

Homosólen (Gr. *homoios*, similar, and *sôlen*, a tube).—A delicate branching coral of the Chalk formation, composed, according to Lonsdale, "of large and small tubes of similar form, all inclined in the same direction, partially visible on the surface, and limited to one side of the coral; mouths simple tubular extremities; back without pores, and forming a continuous lamina."

Homóiozoic (Gr. *homoios*, the same, and *zoe*, life).—Zones or belts of the ocean which, being under nearly the same circumstances as to climate, and consequently peopled in their different parts either by the same or representative species of animals, are said to be *homoiozoic*, or marked by the same life.

Homólogous, Homólogous (Gr. *homos*, the same, and *logos*, reasoning).—"Analogue" has reference to *similarity of function*, as the wing of the bird and the dermal expansion of the bat, because they each enable their respective possessors to fly, or sustain themselves in the air. Homologue, on the other hand, has reference to *identity of parts*, as the bone of the fore-limb, or *humerus*, whether it occurs in the arm of man, the wing

of a bird, the paddle of a whale, or the fore-leg of the horse.—See ANALOGUE and AFFINITY.

Homology (Gr. *homos*, the same, and *logos*, reasoning).—In general terms, the idea or doctrine of the answerable relation of parts in animal structures; e.g., the bones of the human arm and hand find their homologues or answerable parts in the wing of the bird, in the fore-limb of the quadruped, and in the paddle of the whale—the identical parts being modified, fused together, or atrophied, so as best to answer the functions or economy of the animal. As with the homologies of the vertebrate skeleton or bones, so also with regard to the crust or outer skeleton and its appendages in the *articulata*; and so also, as science advances, “the next important step,” remarks Professor Owen, “will be to determine the homologous parts of the nervous system, of the muscular system, of the respiratory and vascular system, and of the digestive, secretory, and generative organs in the same primary group or province.”—See Owen’s ‘Archetype of the Skeleton,’ and Ogilvie’s ‘Master-Builder’s Plan,’ for the doctrine of Homology.

Hone (Sax. *hoen*).—Whet-slate; whet-stone. The best hones, or oilstones, as they are generally termed by the workmen using them, are obtained from those varieties of talc-slate which are sufficiently compact, and in which the particles of quartz are extremely minute and regularly disseminated, so as to give them a uniform consistence. Among the varieties most prized are—the *Turkey oilstones*, obtained from the interior of Asia Minor; the *German razor-hone*, from the slate hills in the neighbourhood of Ratisbon; the *Arkansas oilstone*, from North America; the *Water-of-Ayr* or *Snakestone*, chiefly used for polishing copper plates; the *Welsh* and *Devon oilstones*; the *Charnley Forest oilstone*, from Leicestershire; and the *Norway ragstone*, of a coarser and keener texture than the ordinary hones or oilstones.

Honeystone.—A popular synonyme of *mellite* or *mellitite*, which derives its name from its honey-yellow colour.—See MELLITE.

Hoo-Cannel.—A miner’s term in Yorkshire and Lancashire for an earthy and impure variety of cannel coal, showing lines of lamination like splint and other varieties of ordinary coal.

Horizon (Gr., from *horizo*, to bound, *horos*, a limit).—The horizon is usually defined as “the line that terminates the view, when extended on the surface of the earth; or a great circle of the sphere, dividing the world into two parts or hemispheres; the upper hemisphere which is visible, and the lower which is hid. The horizon is *sensible*, and *natural* or *real*. The sensible, apparent, or visible horizon, is a lesser circle of the sphere, which divides the visible part of the sphere from the invisible. It is eastern or western; the eastern is that wherein the sun and stars rise; the western, that wherein they set. The natural, true, or astronomical horizon, is a great circle whose plane passes through the centre of the earth, and whose poles are the nadir and zenith. This horizon would bound the sight if the eye could take in the whole hemisphere.” In familiar language, the line that bounds the view, and where earth and sky seem to meet.

Hornblende.—The *amphibole* of Haily. A simple mineral of frequent occurrence in granitic and trappean rocks; so called from its horn-like cleavage and peculiar lustre (*blenden*, to dazzle). In mineralogy it is often taken as the type of a family under which are arranged *hornblende*, *augite*, *hypersthene*, *bronzeite*, *diallage*, &c.; and lithologically it enters largely into the composition of many of the granites, syenites, greenstones, and por-

phyries. Of Hornblende proper there are several varieties (tremolite, actynolite, asbestos, &c.), the ordinary or common variety being of a black or dark-green colour, and occurring in flat prismatic crystals in fibrous and radiated aggregates, or in lamellar, granular masses. Analyses also show considerable variations in composition, the chief ingredients being silica (46 to 60), magnesia (14 to 28), lime (7 to 14), with minor proportions of iron protoxide, alumina, and fluoric acid. It is softer than quartz or felspar, but heavier than either; it is also heavier, and contains more silica, but is softer and more fusible than augite; its lamellar structure and softness distinguish it from schorl; and it emits a peculiar bitter odour when breathed on. It generally occurs confusedly crystalline, forming with quartz "hornblende rock," which is massive, and "hornblende schist," which is fissile and slaty; with quartz and felspar it forms "syenite;" and with felspar alone, the numerous varieties of "greenstone." As a mineral, hornblende is often confounded with augite, and from their similarity it has even been proposed to unite them into one species. "The former, however," as has been well remarked by Prof. Nicol, "contains more silica, and Bonsdorf has found in it from $\frac{1}{2}$ to 1 per cent of fluoric acid, which does not appear in the latter. Hornblende, too, is more fusible than augite, and ranges lower in specific gravity. Though both possess a cleavage parallel to their vertical prisms, yet these differ in angular dimensions, and both are never observed in the same individual. These minerals also occur in distinct geognostic positions: hornblende in rocks containing quartz or free silica, and mostly with minerals that are neutral compounds of silica, as orthoclase and albite; augite in rocks that do not contain free silica, and mostly with minerals that are not neutral silicates, as labradorite, olivine, and leucite. Hence there are two distinct series of massive or igneous rocks—the *hornblende series*, including granite, syenite, diorite, diorite porphyry, and red porphyry; and the *augite series* or hypersthene rock, gabbro, dolerite, nepheline rock, augite porphyry, and leucite porphyry."—See tabulations, "MINERAL SCHEME."

Hornitos or Hornos.—Literally *ovens*; a Spanish term for the low oven-shaped mounds or hillocks so frequent in the volcanic districts of South America, and from whose sides and summits columns of hot smoke and other vapours are usually emitted. They are only a few feet in height (five to ten), and, according to Humboldt, are not *eruptive cones*, but mere intumescences on the fields and sides of the larger volcanoes. They occur in vast numbers, sending up their dense hot vapours to the height of twenty or thirty feet, and in many of them a subterranean noise is heard, which appears to announce the proximity of a fluid in ebullition.

Hornstone.—A mixed siliceous mineral and rock of various colours (generally grey, tinged with blue, green, brown, or yellow), having a dull splintery or sub-conchoidal fracture, and very much the aspect of a tough massive flint or chert. Indeed it is often difficult to distinguish between jasper, flint, and hornstone, though the latter term is more properly applied to all compact, tough, and massive varieties of siliceous rock, having in general a tendency to the slaty structure, and in the small fracture less translucent than the flints and jaspers. It consists chiefly of siliceous, with a varying proportion of alumina, and differs from the felspars in containing neither soda nor potash; hence its infusibility. A common igneous rock, consisting of hornstone, with imbedded crystals of quartz or felspar, is known as *hornstone porphyry*. "Hornstone," says Mr Bristow, "is used for

snuff-boxes, seals, mortars, &c., but chiefly for the handles of knives and forks. It is exported from Germany in large quantities for mounting butter and dessert knives."

Horse.—Remains of the existing genus *Equus* are not known in deposits of earlier date than the Pleistocene or uppermost Tertiary epoch. Bones and teeth of more than one species occur in the alluvia, osseous breccias, and bone-caves of Europe, Asia, and America, although in the latter continent the horse was extinct at the period of its discovery by Columbus. A closely allied form (*Hippotherium*), distinguished by the extreme length and slenderness of its limbs, and about the size of a common deer, occurs, however, in the Siwalik deposits associated with the gigantic pachyderms, ruminants, and carnivora of that celebrated region. **Horse.**—In mining, a somewhat indefinite term, but usually applied to some obstructing mass of rock-matter that lies in the way of the miner, whether situated in a metalliferous vein or in the body of a coal-seam.

Horses' Teeth.—A quarryman's term for the large independent crystals of felspar which occur in the granites of Devon and Cornwall, and give to them their well-known porphyritic character. The term has reference to the elongated shape and whitish colour of these crystals.

Huckle.—A provincial mining term, used in Staffordshire and Derbyshire to designate the summit or apex of an anticline or saddle-back. As many of these saddles are sharply curved they are necessarily jointed and fissured, and that main joint which passes through the crown downwards is known as the "huckle-joint" or "saddle-joint."

Humboldtite (after Humboldt).—A rather rare mineral, occurring in thick tabular or short prismatic crystals of a pale honey colour in the ejected blocks on Mount Vesuvius. Consists, according to Von Kobell, of 43.96 silica, 11.20 alumina, 31.96 lime, 6.10 magnesia, 2.32 iron peroxide, 4.28 soda, and a trace of potash.

Humboldtine.—Known also as *Oxalite*. A native oxalate of iron occurring in yellowish capillary crystals in the brown coal of Germany.

Humite (after Sir A. Hume).—A variety of *Chondrodite*. A gem of a transparent vitreous brown colour, found in the ejected masses of Monte Somma, Vesuvius.

Hummock (Sax., a knoll or mound).—Applied by sailors to blocks and masses of ice which have been frozen together so as to produce a rugged and uneven surface of the general ice-field.

Humus (Lat. *humus*, the soil).—When wood or woody fibre is exposed to the action of air and moisture, it suffers *eremacausis* or decay, and crumbles down into a black or dark brown powder commonly called *vegetable mould*, and to which chemists give the name of *humus*.—See EREMACAUSIS.

Huronian System.—A term applied by Sir W. Logan and the Canadian geologists to a vast formation of strata (in parts metamorphic) of siliceous sandstones and conglomerates, chloritic and quartzose schists, and crystalline limestones, interstratified with heavy beds of greenstone—the whole resting unconformably upon the Laurentian formation. The system contains important metalliferous veins, particularly of native copper; is destitute of organic remains; and is considered the equivalent of the lower Cambrian rocks of Britain. It derives its name from its extensive development in the neighbourhood of Lakes Superior and Huron, where it acquires a total thickness of about 12,000 feet.

Hurricane (Sp., allied to Lat. *furio*, I rage).—A violent storm of wind, usually accompanied by thunder and lightning, and by rain or hail, and further characterised by its sudden changes and fitful vehemence. Hurricanes are most frequent in tropical and sub-tropical latitudes; appear to have an electrical origin; and are alike destructive whether on land or at sea.—*Typhoons* and *Cyclones* are special varieties, which see.

Hyacinth (Gr. *hyakinthos*, said to be from an Oriental word *yacunt*, signifying *ruby*).—A variety of pyramidal zircon, of a brilliant hyacinth-red. It is esteemed one of the gems, and is usually found in alluvial sands and gravels along with rubies, sapphires, and the like.—See **ZIRCON**.

Hyæna.—Bones, teeth, and the fossil excrement (*album græcum*) of hyænas are common in all the ossiferous caverns and breccias of Europe—some of these remains indicating species larger and more powerful than any of the existing species of Africa.

Hyænodon.—A carnivorous quadruped about the size of a large hyæna or leopard, found in the eocene and miocene Tertiaries of Europe, and specially characterised by its flesh-cutting teeth (carnassials), which, "instead of being one in each ramus of the jaw, as in modern felines, were three in number, and equally fitted by their trenchant shape to act like scissor-blades on the teeth of the upper jaw in the act of cutting flesh."

Hyaline (Gr. *hyalos*, glass).—Glassy; having the lustre and transparency of glass.

Hyalite (Gr. *hyalos*, glass, and *lithos*, stone).—Glassy opal, or *Muller's Glass*. A variety of opal found transparent, colourless, very glassy, small concretions or incrustations in vesicular basalt and basaltic greenstone.

Hyalosiderite (Gr. *hyalos*, glass, and *sideros*, iron).—A brown or yellow-coloured, very ferruginous and metallic-looking variety of olivine.—See **OLIVINE** and **CHRYSOCLITE**.

Hybodus, **Hybodonts** (Gr. *hybos*, a hump, and *odous*, tooth).—Intermediate between the Cestracions with obtuse crushing teeth, and the Squaloids with sharp, angular, and pointed ones, are those fishes which Agassiz has arranged in a sub-family or group under the title *Hybodonts*. The teeth are the principal parts yet known, and these are transversely elongate, and furnished with a series of sub-conical cusps or knobs which compose the crown; hence the name. Teeth and spines of the genus are common in the Trias, Oolite and Chalk systems—the former being readily distinguished by their knobbed crowns—the principal cusp or hump being in the centre.

Hybrid (Gr. *hybris*, wanton excess, lascivious assault).—The offspring of two nearly allied species, whether animal or vegetable—*e.g.*, the mule, which is a hybrid between the horse and the ass. In the animal kingdom hybrids are naturally of very rare occurrence; and in the vegetable kingdom they are for the most part produced by artificial fecundation; that is, by crossing two species of the same genus, or two varieties of the same species—the *pollen* or fertilising principle of the one being applied to the pistil of the other.

Hydr, **Hydro**- (Gr. *hydor*, water).—A common prefix denoting the presence, action, or quality of water; also the presence of **HYDROGEN** in certain chemical compounds; as *hydrosilicite*, a mineral composed of silica and water; *hydraulic* press, an apparatus acting by the pressure of water; *hydraulic* cement, mortar that sets or hardens under water; and *hydro-carbon*, a compound of hydrogen and carbon.

HYD

Hydrárgillite (Gr. *hydor*, and *argilla*, clay).—A rarish mineral occurring in small hexagonal crystals, and, as the name imports, composed of alumina and water. Some specimens, however, yield a small percentage of phosphoric acid, thus making it a *phosphate of alumina*.

Hydrates (Gr. *hydor*, water).—A term applied to compounds containing water in a state of chemical combination, and in definite proportions; as *hydrate of lime* (slaked lime), *hydrated oxide of iron* (iron rust), *hydrate of magnesia* (Brucite), *hydrate of alumina* (diaspore), &c. Water thus unites with several of the acids, the alkalies, and all salts that contain water of crystallisation.

Hydraulic Cement.—Any cement or mortar which sets or becomes hard under water. Common lime does not possess this property; but limestones containing from 10 to 25 per cent of alumina, magnesia, and silica, yield a lime on burning, which does not slake when moistened with water, but forms a mortar with it, which hardens in a few days when covered by water. *Puzzuolana*, *septaria*, certain *argillo-siliceous limestones* and *calcareous earths*, burnt either with or without the addition of common limestone, form the usual "hydraulic cements."—See CEMENTS.

Hydroboracite.—Hydrated borate of magnesia and lime; a gypseous-looking compound having a radiating-fibrous and foliated structure, but distinguished from gypsum by its fusibility. In the mass, it is riddled with small holes, like worm-eaten wood, these being filled with clay and salt, and is generally freckled with spots of iron-oxide.

Hydroborocalcite or **Hayesine**, which see.—The name has reference to the composition of the mineral—viz., *hydor*, water; *boron*; and *calx*, *calcia*, lime.

Hydro-Carbons.—Composed of hydrogen and carbon. A term usually applied to the bitumens, mineral resins, and mineral fats, which are chiefly or altogether composed of hydrogen and carbon in varying proportions; as naphtha, petroleum, asphalt, amber, ozokerite, &c.

Hydro-Carburet.—Carburetted hydrogen; a compound of hydrogen and carbon. There are several definite combinations of these elements, such as *light carbonetted hydrogen* or *fire-damp*, and *olefiant gas*, *bi-carburet of hydrogen*.

Hydrogen (Gr. *hydor*, and *gennao*, I produce).—Literally "water-former;" one of the elementary gases which occurs most generally and abundantly in combination with oxygen, in the form of *water*—water being composed of eight parts by weight of oxygen and one of hydrogen, or of one volume of oxygen and two of hydrogen. As a simple substance hydrogen is colourless, and has commonly a slight odour of garlic; is not absorbable by water; is devoid of taste, and is destructive of life when breathed for any time. It is the lightest of all known bodies—100 cubic inches weighing only 2.25 grains, or being nearly thirteen times lighter than atmospheric air (as 69 to 1000), and exactly sixteen times lighter than oxygen. It is combustible, and when pure burns with a pale-blue flame; hence the early terms "inflammable air," and "phlogiston." In nature hydrogen is an abundant substance, and next to oxygen enters most largely into the composition of the earth's crust. In common with other gases, it is evolved by volcanic vents; as light carburetted hydrogen or fire-damp it is discharged from coal-mines and other openings in connection with *caly strata*; in combination with carbon it forms the *hydro-carburets*, naphtha, petroleum, bitumen, &c.; and as sulphuretted hydrogen it is largely discharged by volcanoes, and evolved by organic substances in the process of decay.

Hydrography (Gr. *hydor*, and *grapho*, I write).—That branch of geography which treats of the waters that form part of the surface of the terraqueous globe—as streams, rivers, lakes, seas, and the great ocean. The art of describing and measuring the areas, depths, configurations, currents, velocities, &c., of the oceanic and terrestrial waters.

Hydróida (Gr. *hydra* and *eidos*, hydra-like).—The Hydroid or Hydra-form polypes; an extensive order of zoophytes, occurring singly and independent, or in compound groups. In the compound species the body is implanted in a horny tubular sheath, and the polypidoms form branched corallines, which are fixed at the base to rocks, sea-weeds, and shells. The order embraces the *Hydrida*, *Sertularida*, and *Tubularida*; and under the same head paleontologists would also arrange the extinct *Graptolites* of the Silurian epoch.

Hydrólogy (Gr. *hydor*, and *logos*, discourse).—That department of science which treats of water in all its properties, manifestations, and relations in the economy of nature.

Hydrománesite.—Native carbonate of magnesia, occurring in white earthy, amorphous masses in serpentinous rocks, and consisting of 36.2 carbonic acid, 44 magnesia, and 19.8 water.

Hydropháns (Gr. *hydor*, and *phaino*, I appear).—A variety of cachalongopal, which is pearly-opaque when dry, but becomes transparent when saturated with water; hence the name.

Hydrophytes (Gr. *hydor*, and *phyton*, a shoot).—Literally “water-plants;” a term occasionally applied to the *algæ*, *fuci*, and other strictly aquatic vegetation, whether fresh-water or marine. They occur fossil in all formations, but generally in states too imperfect to permit of being classed with existing families.

Hydrothérmal.—Of or pertaining to hot water; applied to the action of heated waters in dissolving, re-depositing, and otherwise producing mineral changes within the crust of the globe. As these waters appear at all temperatures, from gently tepid (80°) to boiling-point (212°), and often far above it when under sufficient pressure, we can readily conceive the importance of their agency in the production of metamorphosis, the formation of mineral veins, and other analogous phenomena.

Hyetography (Gr. *hyetos*, rain, and *graphe*).—The science of rain; the study of the quantities and localities in which rain has fallen in a given time.

Hyetographic.—Of or pertaining to the science of rain, as hyetographic maps—showing by engraved tints, or otherwise, the comparative amount of rainfall in different regions.

Hygrómeter (Gr. *hygros*, moist, and *metron*, a measure).—An instrument for determining the humidity of the atmosphere. There are various kinds of hygrometers—some depending upon the principle of absorption of moisture, others upon the contraction of absorptive materials, and some, again, upon the principle of condensation upon cold polished surfaces.

Hýgroscope (Gr. *hygros*, and *scopeo*, I perceive).—An instrument for indicating the presence of aqueous vapour in the atmosphere, without measuring its exact amount.

Hylæosáuros (Gr. *hyla*, a wood, *weald*, or forest, and *saurus*, lizard).—One of the Dinosaurs; a gigantic terrestrial reptile whose remains were first discovered (1832) by Dr Mantell in the Wealden strata of Tilgate Forest; hence the name. “The Hylæosaurus,” says the discoverer, “so far as the size and form of its body may be inferred from the remains of

the skeleton hitherto discovered—for of its head and jaws nothing is at present [1851] known—probably attained a length of from twenty to thirty feet. The body was broader than high, and terminated in a long slender flexible tail; the limbs were relatively short; the skin was covered with scutes and tubercles; and a row of very large, thin angular spines extended down the back, and formed a serrated dermal crest. The coracoids, scapulae, and ribs, indicate a pectoral arch, in which were blended the osteological characters of the Monitors and Crocodilians.” The *Hylaeosaurus*, we may add, occupies a prominent place among the Palaeontological restorations in the Crystal Palace Gardens.

Hylérpeton (Gr. *hyle*, wood, and *serpeton*, reptile).—A provisional genus of reptiles, apparently belonging to the lower and earlier order of *Ganocephala*, and instituted by Professor Owen to embrace some fragmentary remains of jaws and teeth from the Nova-Scotian coal-field.

Hylónomus (Gr. *hyle*, a wood, and *nomos*, an abode).—Literally “wood-dweller;” a small lacertian reptile, several species of which have been discovered by Principal Dawson enclosed in the fossil trunks of sigillariae from the lower Coal-measures of Nova Scotia. Other reptiles (*dendroserpeton*), small myriapods (*xylobius*), and land-shells like *pupa*, have been found in similar situations in the same formation.

Hyménocaris (Gr. *hymen*, membrane, and *caris*, shrimp).—A small phyllopod or shrimp-like crustacean of the Silurian epoch, having its anterior portion enclosed in a thin bivalvular carapace, and its abdominal or terminal segments free, and capable of being turned under the body.

Hypótamns (Gr. *hys*, *hyos*, a hog, and *potamos*, river).—Literally “river-hog;” a non-ruminant, even-toed (*artiodactyle*) mammal, whose remains occur in the Tertiary strata of England and France. Described by Professor Owen (‘Geological Journal,’ vol. iv.), who regards it as allied to the *Anthracotheurium*, *Charopotamus*, and other hog-like mammals of that period.

Hyp-, Hypo- (Gr. *hypo*, under).—A common prefix in scientific terminology signifying *under* or *below*, in reference to place or position, and indicating *deficiency* or *less than* when applied to quality or composition; as *hypogene*, formed below; *hyponitrous acid*, an acid intermediate between nitric oxide and nitrous acid. Synonymous with the Latin prefix *sub*.

Hypanthócorinus (Gr. *hypantheo*, to begin to flower).—A genus of Rose-encrinites, occurring in Upper Silurian strata, and so termed from the flower-like contour of its ornamental receptacle and bifurcating arms. The column is cylindrical, but traversed internally by a pentagonal canal.

Hyper- (Gr. *hyper*, above).—A frequent prefix in scientific terminology, signifying *above* or *upon*, in reference to places or position, and indicating *excess*, with regard to quality or composition. Thus *hyperthyrum*, the lintel or over-piece of a doorway; *hypercriticism*, exaggerated or excessive criticism; *hypertrophy*, a morbid enlargement of any organ, as if from excess of nutrition. Synonymous with the Latin prefix *super*.

Hýpersthene (Gr. *hyper*, above or excess, and *sthenos*, strength).—A mineral of the Hornblende family, so called from its power of resisting acids as compared with augite, to which it is closely related—the “prismatic schiller-spar” of Mohs, and the “Labrador hornblende” of other authors. It occurs massive, in crystalline and granular aggregates, or disseminated; has a vitreo-resinous lustre, but pearly-metallic on the

principal cleavage-planes; and has usually a pinchbeck-brown or greyish-green colour, passing into black. It is a ferrosilicate of magnesia, with traces of alumina and lime, and differs in this respect from augite, which contains from 18 to 24 per cent of lime. It is a constituent of several rocks, forming, with labradorite, "hypersthene rock;" with labradorite and chlorite, "diabase;" and it occurs also in the euphotide or "gabbro." Hypersthene rock is common in primary districts, and in Sweden the finer varieties are polished as an ornamental stone.

Hypogène (Gr. *hypo*, under, and *ginomai*, I am formed).—"As all the crystalline rocks," says Lyell, "may, in some respects, be viewed as belonging to one great family, whether they be stratified or unstratified, plutonic or metamorphic, it will often be convenient to speak of them by one common name. For this purpose I propose the term 'hypogene'—a word implying the theory that granite, gneiss, and the other crystalline formations, are alike *nether-formed* rocks, or rocks which have not assumed their present form and structure at the surface. They occupy the lowest place in the order of superposition. Even in regions such as the Alps, where some masses of granite can be shown to be of Tertiary epoch, they are still *underlying* rocks."

Hypostilbite.—By some mineralogists regarded as an altered form of stilbite, and by others as a distinct mineral or hydrated lime-oligoclase. Occurs with stilbite, &c., in the Farø Islands.

Hypozoic (Gr. *hypo*, under, and *zoe*, life).—Applied to those rocks which, like gneiss and mica-schist, lie beneath the undoubtedly fossiliferous strata, and which have yet yielded no organic remains. "Azoic," which is also applied to these rocks, means destitute of fossils; "hypozoic" simply points out their position, without offering any opinion as to their fossiliferous or non-fossiliferous character. Since the discovery of organisms in the Laurentian schists of Canada, it is very questionable whether any of the stratified rocks can be considered as strictly *Azoic* or *Hypozoic*.—See tabulations, "GEOLOGICAL SCHEME."

Hypsiprymnopsis.—A genus of small mammals whose teeth have been found by Mr B. Dawkins in the Rhetic or Infra-Liassic beds of Watchet in Somersetshire, and so named from the resemblance that these bear to the teeth of the existing *Hypsiprymnus* or Kangaroo-rat of Australia.

Hypsodon (Gr. *hypsos*, height, and *odous*, tooth).—Literally "tall-tooth;" a genus of saury-pikes (*scomber-esocidae*) occurring in the Chalk of Kent and Sussex, and so termed from their extremely upright, long, conical, compressed, and pointed teeth. The teeth and fragments discovered indicate fishes of a very large size.

Hyracotherium (Gr. *hyrax*, the hare-rat or cony, and *therion*, beast).—A small pachydermatous mammal, occurring in the Tertiary strata of England, and so termed by Professor Owen ('Foss. Mammals'), from its apparent relationship to the *Hyracida* or Conies of Southern Africa. The genus stands intermediate between the Hog and Hyrax; and the species range from the size of a rabbit to that of a large hare.

I

Ice (Sax. ; Ger. *eis*).—The familiar as well as technical term for *frozen water*, or water converted into the solid state under the influence of extreme cold. Water is at its minimum volume when about 40° Fabr., and above or under this temperature it increases in bulk—passing into steam on the one hand, and being converted into ice on the other. At 32° or under, it exists in the condition of ice; and this ice, being greater in volume than the water of which it is composed, is lighter, and consequently floats on the surface. It is owing to this expansion of water that frost becomes such a powerful agent in the disintegration of soils and rock-masses—the water in their interstices being converted into ice, and irresistibly breaking asunder the cohesion of their parts. It is also owing to this lightness and floating power that we have the phenomena of *ground-ice* lifting up and transporting masses of shingle and sand—of *icebergs* floating their burdens of boulders and rock-debris, and scattering them over the bed of the ocean—and of *avalanche* and *glacier* wasting, smoothing, and moulding into new forms the contours of all arctic and Alpine mountains.—See FROST.

Iceberg (Ger. *eis*, ice, and *berg*, mountain).—The name given to the mountainous masses of ice often found floating in polar seas. Sometimes they are formed by the accumulation of ice and snow on the surface of the water; at other times they seem to have been originally glaciers launched from precipitous coasts into the ocean, and there further augmented by numbers of them freezing *en masse*. These “fields” or “packs” are often of great extent—stretching across the ocean as far as the eye can reach, and rising in perpendicular cliffs from 80 to 100 or 150 feet above the water. Solitary or independent icebergs are also often of vast dimensions, and instances are given, both in arctic and antarctic voyages, of *bergs* several miles in circumference, rising from 40 to 200 feet above the sea-level, and loaded with blocks of rocks and shingle. Some idea of their size may be formed from the fact that little more than a tenth of their bulk rises above the surface (the specific gravity of ice being only 0.9)—the greater portion being submerged and apt to be grounded on shoals and flats. As they are floated by the polar currents to warmer latitudes they melt away, dropping their burdens of boulder and rock-debris on the bottom of the ocean. Could we lay bare this sea-bottom, we should find appearances strictly analogous to the “drift” or “boulder-clay” of geologists; and it is in this way that the boulder-clay or Northern Drift, with its water-worn blocks, its gravel and shingle, its smoothed and furrowed rock-surfaces, and other kindred appearances, can alone be accounted for. At the present day icebergs are familiar phenomena both in arctic and antarctic seas—those of the north being seldom carried southward beyond the 44th parallel of latitude, while those of the south are not unfrequently found northward as far as the Cape of Good Hope, or on an average at 10 degrees lower latitude. As the *glacier* smooths and furrows the rocks over which it passes, so the *iceberg*, with its immense weight and greater motion, grinds, and rubs, and ploughs; and while the one lays down its

lateral and terminal moraines in ridge-like mounds, the other carries from the cliffs and shores its mud and gravel and boulders, and strews them along the bottom of the ocean.

Ice-Floe (Dan., ice-island).—Applied by voyagers to the smaller masses of ice that encumber the polar seas. Floes are rarely a quarter of a mile in circumference, and usually much smaller.

Iceland-Spar.—A variety of calcareous spar remarkable for its transparency and double refraction. According to Nicol, it is not found in crystals, but occurs massive in a trap-rock in Iceland, and has been considered as a portion of altered limestone.

Ice-Spar.—A familiar term for a variety of orthoclase or common prismatic felspar; transparent or translucent; colourless and white, or but slightly tinged with grey or faint yellowish-green; and of a vitreous or glassy lustre.—See FELSPAR.

Ichhnites (Gr. *ichnos*, a footprint).—A term applied to all fossil footprints, many of which have been discovered in palæozoic and secondary formations—as *ornithichhnites*, bird-footsteps; *sauroidichhnites*, saurian footsteps, &c. Footprints, supposed to be those of reptiles, have been discovered in rocks of Devonian age in Canada, and in Scotland, and also in the Coal-measures of Europe and America; and those of reptiles, birds, and undetermined animals occur abundantly in the New Red Sandstone of Britain, Germany, and North America. These creatures seem to have frequented muddy shores and estuaries, and to have left the impress of their feet on the yielding and half-dried mud, over which the next deposit of sediment spread and filled up the mould. On splitting many of these sediments (now converted into shales and sandstones) the mould and its cast are found in great perfection—so much so that not only the joints of the toes, but the very texture of the skin is apparent. Hildburghausen in Saxony, Corncockle Muir in Dumfriesshire, Stourton, Weston, and Taporley in Cheshire, Grimsell in Shropshire, and the valley of the Connecticut in North America, are the localities most celebrated for their fossil footprints—and this in strata of Permian or of Triassic age.

Ichhnolite (Gr. *ichnos*, a footprint, and *lithos*, stone).—Any fossil footmark, or stone retaining the impression of the feet of extinct animals.

Ichhnology, Ichhnolithology (Gr. *ichnos*, a footprint, *lithos*, and *logos*).—The science of fossil footprints; e.g., the 'Ichhnology of Annandale,' by Sir William Jardine; the 'Ichhnology of New England,' by Dr Hitchcock.

Ichthyocóprus, Ichthyocóprolite (Gr. *ichthys*, fish; *copros*, excrement; and *lithos*).—Literally, the fossil excrement of fishes. Coprolites of this nature occur in all the Secondary formations; but in great profusion and of gigantic size in the shales of the lower Coal formation.

Ichthyodórule (Gr. *ichthys*, fish; *doru*, spear; and *lithos*, stone).—The fossil fin-spines or defences of fishes, found abundantly in all the fossiliferous strata—those of the shark-like fishes (*Cestracionts*) of the lower Coal-measures being often more than a foot in length, and strong in proportion. These spines are generally straight and tapering, but many of them are more or less recurved or falcate. The inserted portion is blunt and plain; the external defence enamelled and often highly sculptured—some being grooved transversely and spirally (*gyracanthus*), others striated or fluted longitudinally (*onchus*); some ornamented with points and tubercles (*cosmacanthus*), and others serrated or hooked on the posterior margin (*ctenacanthus*).

Ichthyoid (Gr. *ichthys*, fish, and *eidos*, likeness).—Fish-like; partaking of the fish type, as the ichthyosaurus, which is partly ichthyoid and partly sauroid.

Ichthyolite (Gr. *ichthys*, fish, and *lithos*, stone).—A palaeontological term for a fossil fish, or any portion of a fish, as a scale, tooth, spine, &c. The most celebrated deposits of fossil fishes in Europe are the bituminous schists of the lower Old Red of Orkney, Caithness, and Forfar; the yellow sandstones (upper Old Red) of Dura Den, Fifeshire; the lower Coal-measures of Burdiehouse, &c., near Edinburgh; the Coal formation of Saarbrück in Lorraine; the Permian bituminous slate of Mansfield in Thuringia; the calcareous lithographic slate of Solenhofen (Oolitic); the compact blue slaty shale of Glaris (cretaceous); and the Tertiary limestones of Monte Bolca, near Verona, the marlstones of Oeningen in Switzerland, and of Aix in Provence.

Ichthyology (Gr. *ichthys*, fish, and *logos*, discourse).—That branch of zoology which treats of the structure, classification, habits, and history of fishes; *Ichthyological*, relating to the science of ichthyology; *Ichthyologist*, one who studies, or is devoted to, the science of fishes.—See **PISCES**, and tabulations, "**ANIMAL SCHEME**."

Ichthyopátolites (Gr. *ichthys*, fish; *patos*, footpath; and *lithos*, stone).—Fish-tracks, or the imprints of the pectoral fin-rays of certain fishes, which, like the gurnard and climbing perch, can move on solid surfaces by means of these organs. Under this name Dr Buckland described ('Proceedings of Geol. Soc.,' vol. iv.) certain problematical markings observed on a flagstone from the Coal-measures of Flintshire. It consists of curvilinear scratches or imprints, disposed symmetrically at regular intervals on each side a smooth level space, about two inches wide, which may correspond to the body of a fish, the pectoral fins of which, Dr Buckland suggests, were the instruments that formed the markings in question.

Ichthyophagous (Gr. *ichthys*, fish, and *phagein*, to eat).—Fish-eating; feeding on fish.

Ichthyophthalmite (Gr. *ichthys*, and *ophthalmos*, the eye).—Fish-eye-stone; a variety of *apophyllite* or pyramidal zeolite, characterised by its peculiar pearly lustre.

Ichthyopterygia (Gr. *ichthys*, a fish, and *pteryx*, a wing or fin).—One of the thirteen orders into which Professor Owen proposes to arrange the Reptilia, living and extinct. The term relates to the piscine character of the numerous and many-jointed rays or digits in the fore and hind paddles. The *ichthyosaurus* may be taken as the type of the order, the genera of which are exclusively marine. The bones of the head include the "post-orbital" and "supra-temporal" bones that characterise the Labyrinthodonts and Ganocephalans, but there are temporal and other vacuities between the cranial bones; there is a single, convex, occipital condyle; the vertebral centres are ossified and biconcave; the pleurapophyses long and bent,—the anterior ones with bifurcate heads; the teeth are confined to the maxillary, premaxillary, and premandibular bones,—the premaxillary greatly exceeding in size; the orbits large, the eyes being defended by a broad circle of sclerotic plates; the limbs natatory, with more than five many-jointed digits; no sacrum.

Ichthyosárcolite (Gr. *ichthys*, fish; *sarcos*, flesh; and *lithos*, stone).—Literally, "fish-flesh-stone;" a term at one time applied to certain thick, heavy, tapering organisms from the Chalk, in allusion to their flaky or

foliaceous structure. They are now known as *Radiolites* and *Sphærolites*, peculiar bivalve shells belonging to the family HIPFURITIDÆ, which see.

Ichthyosaurus (Gr. *ichthys*, fish, and *saurus*, lizard).—Literally “fish-lizard;” a well-known genus of the extinct *Enaliosaurs* or marine saurians, and so called from its combining the characters of saurian reptiles and of fishes with some of the peculiarities of the whales. The ichthyosaurs were in fact the “reptile whales” of their period—a period extending from the deposition of the middle Trias or muschelkalk till near the close of the Chalk formation. The peculiarities of their structure have been thus described:—Their vertebrae resemble those of fishes in being biconcave, or concave at both ends; but the superior arches remain permanently detached as in reptiles. The cranium resembles that of the crocodiles, but is characterized by a peculiarly large eye-orbit furnished with a circular series of bony sclerotic plates—a structure not occurring in fishes, but observable in the eyes of turtles, lizards, and many birds. The nostrils are situated, not, as in the crocodile, near the extremity of the snout, but close to the anterior part of the orbit, approaching in this respect some of the recent lizards. The teeth, which are extremely numerous (amounting in some species to nearly 200), resemble in structure those of the crocodiles—being conical, longitudinally striated, and expanded at the base; but are implanted, as in some of the lizards, in a deep continuous groove, and not in distinct sockets. The locomotive extremities are similar in construction to the paddles of the whale; but they are four instead of two in number, and the front paddles are connected by a broad coracoid, a complete clavicle, and a supplementary coracoid bone to a strong sternum; the flattened phalangeal bones supporting the fin are polygonal, and are relatively shorter and more numerous than in the whale. The hind paddles are smaller than the fore, and are attached to a pelvis similar to that of the crocodile. Small supplemental bones are wedged into the lower part of the joint of the atlas and occiput, and a few of the succeeding vertebral joints; and the tail often presents a fracture or abrupt bend about a third of its length from the extremity, as if it had been swayed aside during decomposition by the weight of a large vertical tail-fin. From the form and position of masses of crushed and apparently half-digested fish-bones and scales in the abdominal cavity of certain specimens, it is concluded that they preyed on fish; and from the shape of their *coprolites* (fossil excrements) it is obvious that their intestinal canals were furnished with spiral valves as in the sharks. In one or two instances, very small, and to all appearance *fœtal* specimens, have been found within the pelvic cavities of large skeletons, and from this circumstance it has been inferred that the ichthyosaurs, like the whales, were viviparous. As already mentioned, the great era of ichthyosaur development was from the middle Trias to the Chalk inclusive—the Lias formation being the chief repository of their remains in England. In this deposit specimens of all ages and of all sizes have been found—from the fœtus of a few inches to the adult more than thirty feet in length; and of these the finest are now preserved in the British Museum, and the museum at York.

Idocrase (Gr. *eidos*, form, and *krasis*, mixture).—Known also as Vesuvian and Pyramidal Garnet, and differs from common garnet chiefly in form. Idocrase (so termed from its crystalline forms being *mixed figures*, which are apt to be mistaken for those of other minerals) was originally found in the ejected calcareous blocks on Vesuvius, in druses with garnet, augite,

&c. ; but it also occurs in subordinate beds in the primitive rocks with calc-spar, garnet, epidote, chlorite, and other silicates. It forms an indifferent ornamental stone, the brown being named *hyacinth*, and sold at Naples under the name of "Gemmae de Vesuve;" the green, *chrysolite*. Several local varieties are also distinguished, as *Wiluite*, from Wiloui in Siberia, an obscure green; *Cyprine*, a blue variety containing copper, from Norway; and *Egrane*, a liver-brown sort from Eger in Bohemia.

I'drialine, Idrialite.—One of the mineral resins, so named from its being found at Idria in Carniola, in thin layers among the slates containing the mercury ores. It occurs in soft, brownish-black, flaky masses, having a resinous lustre and a greasy feel; and from these masses, which consist of idrialine and cinnabar, with a little silica, alumina, pyrites, and lime, the pure pearly *idrialine* may be extracted by oil of turpentine.

Igneous (Lat. *ignis*, fire).—Applied to all agencies, operations, and results which seem connected with, or to have arisen from, subterranean heat, as "igneous rocks," "igneous fusion," &c. The *igneous rocks*, properly so called, comprehend the Volcanic, Trappean, and Granitic series, all of which are evidently the products of fusion either in the interior or at the surface of the crust. The term *igneous* is thus synonymous with *unstratified*, *Plutonic*, *pyrogenous*, and others in use by geologists.

Ignigenous (Lat. *ignis*, and Gr. *ginomai*, I am formed).—Fire-formed; used as synonymous with igneous, though, properly speaking, *igneous* refers to the operation or agency, and *ignigenous* to the result.

Iguanodon.—One of the Dinosaurs; a colossal lizard-like reptile found in the Wealden strata, and so called from the resemblance of its teeth to those of the existing iguana of South America. "According to the present state of our knowledge," says Dr Mantell in 1851, "it is not at all improbable that the largest iguanodons may have attained a length of from sixty to seventy feet. Although some important points in the osteology of the iguanodon are still unknown, we may safely conclude that the stupendous reptile equalled in bulk the largest herbivorous mammalia, and was as massive in proportions. Its limbs must have been of proportionate size and strength to sustain, and move, so enormous a carcass; the hinder extremities in all probability resembled the unwieldy contour of the hippopotamus or rhinoceros, and were supported by strong short feet, protected by broad unequal phalanges: the fore-feet appear to have been less bulky, and adapted for seizing and pulling down the foliage and branches of trees; the jaws and teeth demonstrate its power of mastication, and the character of its food; while the remains of the coniferous trees, arborescent ferns, and cycadeous plants which are found imbedded with its remains, attest the nature of the flora adapted for its sustenance." The iguanodon occupies a chief place among Mr Hawkins's palæontological restorations in the grounds of the Crystal Palace.

Ilmenite.—Known also as *tilanitic iron*; an ore of iron occurring in various formations, as in the miascite of the Ilmen mountains: hence the name. According to H. Rose and Scheerer, it is a combination of peroxide of iron and the blue oxide of titanium in various proportions—the specific gravity increasing with the amount of iron.

Imbricated (Lat. *imbrex*, a gutter-tile).—Overlapping, or laid over each other like the tiles of a roof; applied to the scales of fishes, the scutes of reptiles, the persistent leaflets or petioles of certain trees, &c.

Impalpable (Lat.)—Not perceptible to the touch; applied to dust,

powdery substances, mud, and the like, in which no gritty particles can be felt by the touch. Reduced to the minutest particles or ultimate stage of subdivision.

Imperforate, Imperforated (Lat. *im*, not; *per*, through; and *foro*, I bore).—Not perforate; having no opening or passage of communication; not pierced. Applied in various branches of natural science.

Impermeable (Lat. *im*, not; *per*, through; and *meo*, I pass).—Not admitting the passage of water; applied to strata or other masses which, like clay, obstruct the natural passage or percolation of subterranean waters.

Impervious (Lat. *im*, not; *per*, through; and *via*, a way).—Impenetrable; impassable; affording no way or passage. Hence we speak of certain strata being "impervious to water," and so on.

Imponderables (Lat. *in*, priv., and *pondus*, weight).—A term applied in physical science to agents which, like heat, light, and electricity, are destitute of weight, and only known by their effects on other bodies.

Incandescence, Incandescent (Lat. *candescere*, to begin to grow white).—A glowing white heat; having a white heat, or greater degree of heat than red heat.

Incineration (Lat. *in*, and *cinis*, *cineris*, a cinder).—The act of burning or reducing to ashes; distinct from *calcination*, which see.

Incisors (Lat. *in*, and *caedo*, I cut).—The cutting teeth or front teeth of mammals, as distinguished from the grinding or *molar* teeth.—See **TEETH**.

Incombustible (Lat.)—Applied to substances that will not burn, or which cannot be consumed by the action of fire.

Incrustation (Lat. *in*, and *crusta*, a crust or rind).—A crust or coating formed on the surface of any substance. Waters containing lime, clay, and other mineral impurities, leave an "incrustation" on the inside of the vessels in which they are boiled; calcareous waters "incrust" the rocky surfaces over which they flow with a coating of calc-tuff.

Indianite.—A reddish-grey variety of Anorthite (one of the felspars) found in the Carnatic, where it forms the matrix of the corundum. It consists of 42 silica, 34 alumina, and 15 lime, with iron, potash, and soda.

Indian Red.—A kind of ochre (protoxide of iron, silica, and alumina), of a deep red with a shade of purple, imported from the Persian Gulf in small lumps, and partly as a coarse, hard, and gritty powder—the crude material from which the pigment of this name is obtained.

Indicolite, Indigolite.—A variety of tourmaline found at Utoe in Sweden, and so named from its deep-blue indigo colour.

Indigenous (Lat. *in*, and *geno*, I produce).—Born or produced in a particular country; native to a country. Applied to plants and animals, but more especially to the former, in contradistinction to *exotic*; that is, those not native to the country in which they are cultivated.

Indurated (Lat. *durus*, hard).—Restricted in geology to rocks that have been hardened by the action of heat, and in this sense distinct from "hard" or "compact."

Indusial Limestone.—"There is another remarkable form of fresh-water limestone in Auvergne," says Lyell, "called 'indusial,' from the cases or *indusia* of caddis-worms (the larvæ of Phryganea), great heaps of which have been incrustated, as they lay, by carbonate of lime, and formed into a hard travertin. The rock is sometimes purely calcareous, but there is occasionally an intermixture of siliceous matter. Several beds of it are

frequently seen, either in continuous masses or in concretionary nodules, one upon another, with layers of marl interposed." These limestones point, of course, to a time (Eocene) when certain districts of Auvergne were covered by fresh-water lakes, in which the larvæ of the Phryganea swarmed as they do now in the stagnant pools and ditches of England. It is but fair to state that Mr Waterhouse and some other entomologists entertain doubts as to this limestone being really of indusial origin.

Indusium (Lat.)—Literally, a garment or covering. In natural science applied variously; e.g., the *indusium* or case of the caddis-worm; the brown dried epidermis which covers the fertile sori or reproductive specks on the fronds of ferns, &c.

Inflammable Air.—An old chemical term for hydrogen gas: so named on account of its highly inflammable nature.

Infusoria.—Minute animal organisms or animalcules; so called from their being readily obtained (for microscopic investigation) in infusions of vegetable matter which have been freely exposed to the air. In modern zoology they constitute the highest class of the Protozoa, and have been arranged into numerous families which are yet far from being well defined—partly from the minuteness of the organisms, and partly from the liability to mistake for *infusoria* the embryonic germs of other creatures, and, above all, the active germs or spores of the lower forms of vegetation. They are generally unicellular animals; are furnished with a mouth and rudimentary digestive apparatus; and their bodies, for the most part, consist of three distinct layers, the outer of which is usually furnished with cilia or vibratory appendages. They inhabit lakes, pools, and ditches; many are found in the ocean; and some are indifferent alike to salt or fresh water. Mistaking other microscopic forms for *infusoria*, it has been customary to speak of their calcareous and siliceous shields as entering largely into the composition of many recent muds and marls, as well as into that of several of the more ancient stratified deposits; but according to the latest zoological authorities, there are no fossil *infusoria*, the organisms usually designated by this name being either *Foraminifera*, *Polycystina*, or *Diatomacea*.—See PROTOZOA.

Ink-Bags.—In the Squids and Cuttle-fishes the bags or membranes which contain the inky fluid with which these cephalopods discolour the surrounding water when irritated or surprised. These organs have been found fossil in the Lias and Oolite of England in such a state of perfection, that Dr Buckland had drawings of the remains of extinct species of *Sepia* made with their own ink.

Inlier.—A term introduced by Mr Drew, of the Geological Survey, to express the converse of "outlier," which see. "It means," says Mr Drew, "a space occupied by one formation which is completely surrounded by another that rests upon it. It is useful to have a word that well expresses this; and 'inlier' is a very appropriate one; for the circumstance to be named is the exact converse of 'outlier,' which is an isolated mass surrounded by a formation that underlies it."

Inoceramus (Gr. *is*, *inos*, fibre, and *keramos*, vessel-shell).—A genus of fossil bivalves belonging to the *Aviculida* (wing-shells or pearl-oysters), and so named from the fibrous structure of their shells. The valves are unequal, ventriose radiately or concentrically furrowed, umbones prominent; hinge-line straight, elongated, and pitted with numerous close-set cartilage grooves. The species, which range from the Silurian to the Chalk

inclusive, vary in size from one inch to three or four feet in diameter. The shell, in consequence of the vertical arrangement of the fibres, readily breaks to pieces, and large flat fragments are found in the Chalk, often perforated, as in recent oysters, by the *Cliona* (*clionites*). The French restrict the name *Inoceramus* to the beaked and laminated species of the Gault; and arrange the Chalk *Inocerami* under the term *Catillus*.

Inorganic (Lat. *in*, not, and *organum*, a member or instrument).—Not produced by vital action. Applied to mineral substances which are the results of chemical or mechanical aggregation, in contradistinction to vegetable and animal substances, which are produced by vital action, or through the instrumentality of vital organs.—See ORGANIC.

Insect Limestone.—A term applied by the Rev. P. B. Brodie ('History of Fossil Insects') to certain bands of the Lower Lias in the central and western counties of England, from their being charged with the remains of beetles, grasshoppers, dragon-flies, may-flies, and other insects, belonging, according to Mr Westwood, to not fewer than twenty-four families. These insect remains are accompanied by ferns, cycads, and leaves of monocotyledonous plants, and also by some apparently brackish and fresh-water shells, so that they seem to have had an estuary or lagoon origin.

Insecta (Lat. *insectum*, divided into segments).—An extensive class of articulated animals, and so called from the segmented aspect of their bodies. In Cuvier's arrangement it includes the following orders: *Myriapoda* (e.g., centipede); *Thysanoura* (springtail); *Parasita* (louse); *Suctoria* (flea); *Coleoptera* (beetle); *Orthoptera* (earwig); *Hemiptera* (bug); *Neuroptera* (ant-lion); *Hymenoptera* (wasp); *Lepidoptera* (butterfly); *Rhipiptera* (stylops); and *Diptera* (fly). The insects are well known by their segmented bodies, three pairs of feet, one pair of antennæ, compound eyes, generally undergo metamorphosis and acquire wings, and are oviparous, with the sexes distinct. Remains of some of the orders are found as early as the Carboniferous formation, and they abound in the Oolite and later deposits.—See the respective Orders.

Insectivora (Lat. *insecta*, insects, and *voro*, I devour).—An interesting group of the Carnivorous mammalia, characterised by their molar teeth being studded with sharp points, which enables them to feed on insects. The group comprises the mole, hedgehog, shrew, bat, &c. The teeth and jaw-bones of animals apparently insectivorous (*spalacotherium*, *microlestes*, &c.) have been found as low as the Oolite and Upper Trias.

In situ (Lat.)—Literally "in its natural position or place." A rock or fossil is said to be "*in situ*" when it is found in the situation or place in which it was originally formed or deposited; but it is *not in situ* when removed or drifted to another position or locality.

Inspissated (Lat. *in*, and *spissatus*, thickened).—Thickened; made thick by evaporation, whether natural or artificial; as opium, which is the *inspissated juice* of the poppy.

Interambulacra, **Interambulacral** (Lat. *ambulare*, to walk).—The imperforate plates which lie between (*inter*) the perforate plates or *ambulacra* in the shells or crusts of the sea-urchin and cidaris.

Intercalated, **Intercalation** (Lat.)—Interposed, something placed between; the act of placing between. Subordinate beds of a different nature occurring between the main beds of a series are said to be *intercalated*; the occurrence of such beds or of intervals of deposition are said to be *intercalations*. Of frequent use in geology.

Intercolline (Lat. *inter*, between, and *collis*, a hill).—A term proposed by Sir Charles Lyell to designate those valley-like spaces or hollows that occur in volcanic regions between the *cols* or crateriform hillocks of accumulation, and which are not formed by aqueous erosion, nor by subsidence, nor by anticlinal or synclinal flexures, but simply by the building up on two or more sides of erupted materials. Such *intercolline* spaces abound in all volcanic regions of sub-aërial origin.

Intermittent, Intermittent (Lat. *inter*, between, and *mitto*, I send).—Ceasing for a time and then returning; ceasing and acting by turns. *Intermitting Springs* are those which, having flowed for a certain time, stop altogether, and after a time begin to run again, and then stop; and so on alternately, the flowings and intermissions generally succeeding each other at pretty regular intervals. Such phenomena are easily explicable on the supposition of caverns and subterranean areas being fed by small chinks, and discharged by larger fissures acting on the principle of the siphon—the larger outlet, acting more rapidly than the united chinks, when once set a-running, flows till the cavern is emptied, and then ceases till the water again accumulates to its siphon-level.

Interstratified.—Occurring in the midst of, or along with, other strata. In this sense coal may be said to be interstratified with sandstones, shales, fire-clays, and limestones: but the term is generally restricted to those bed-like masses or overflows of igneous rock (lava, basalt, and greenstone) which occur imbedded with true stratified or sedimentary rocks—the igneous overflow having spread over the bottom of the sea of deposit, and been subsequently overlaid by other strata.

Intertropical (Lat. *inter*, between, and *tropical*).—Situated between the tropics; applied also to plants and animals whose habitats lie between the tropics, or in the torrid zone.

Intrusive Rocks.—Applied to those igneous rocks which seem to have thrust themselves (when in a state of fusion) between the beds of the stratified formations. Intrusive masses of this kind are sometimes apt to be mistaken for contemporaneously interbedded overflows; but in general they are not so extensive, wedge-out or thin-out abruptly, and alter the strata both above and below them.

Intumescence (Lat. *intumesco*, to begin to swell).—To swell or bubble up as zeolite and other kindred minerals do under the action of the blow-pipe.

Invertebrata.—One of the two great divisions of the animal kingdom; *animals without vertebrae or back-bones*, including the Mollusca, Articulata, Radiata, and Protozoa.—See tabulations, "ANIMAL SCHEME."

Involutina (Lat. *involvere*, to wind or coil up).—A genus of Foraminifera chiefly from the Lias, and so named by Mr H. Brady, its investigator, from the manner in which the tuberculated tube-like organism is coiled upon itself. The shell-wall between the successive coils is not double as in the true *Rotalina*, with which it is apt to be confounded; the septa are somewhat irregular, but increase with the enlarging whorls; the shell-substance is partly composed of arenaceous grains, indicating a lower organisation than the nummulite; and Mr Brady places it in the family *Liuvolidæ*, and near the genus *Trochammina*.

Iodine (Gr. *ion*, violet, and *eidos*, likeness; violet-coloured).—One of the chemical elements, occurring as a non-metallic, crystallised, acidifying, and basifying solid substance. It is obtained from marine plants, from sea-water, and from certain mineral springs, and is of considerable repute

in *materia medica*. It becomes volatile at a low temperature, and passes off in a beautiful violet-coloured vapour; hence the name.

Iodite or Iodic Silver.—An ore of silver, consisting of iodine and silver, and occurring in thin flexible foliæ or plates of a pearl-grey or yellowish-grey colour. It is found in the mining districts of Mexico and South America, and recently in the south of Spain.

Iolite (Gr. *ion*, violet, and *lithos*, stone).—One of the Gems, known also as *Dichroite*, *Cordierite*, and *Prismatic quartz*. It occurs in granitic and primitive rocks, associated with quartz, garnet, and iron and copper pyrites, and derives its name from its colour, which ranges from violet to dark-blue. It has many allied and doubtful species; and according to Stronmeyer, consists of 48.35 silica, 31.71 alumina, 10.16 magnesia, 8.32 iron protoxide, with traces of manganese. The transparent variety (clear white, with a tinge of celestial blue) found in rolled masses in Ceylon constitutes the *Sapphire d'eau* of the jewellers.

Iridescent (Gr. *iris*, the rainbow).—The property of producing a play of colours resembling those of the rainbow; possessed both by animal and mineral substances. **Iridescence.**—Shining with the colours of the rainbow; a property depending generally on internal structure, or the arrangement of internal surfaces which refract the light; but sometimes also arising from mere external *tarnish*, occasioned by partial decomposition, or the action of acids.

Iridium (Gr. *iris*, the rainbow).—The most infusible of the known metals, and used chiefly in porcelain-painting to produce black and grey colours. It is also used for the nibs of steel-pens, and is said to be worth £24 an ounce. It occurs in nature in combination with platina, palladium, osmium, and copper; and derives its name from the variety of hues which the mixture displays while dissolving in hydro-chloric acid. It was discovered by Dr Wollaston; is of a grey colour, brittle, very infusible, and has a specific gravity of about 18.6.

Irish Deer, Irish Elk.—Remains of the Irish gigantic deer (*Cervus megaceros*, or deer with great antlers) are found in the peat-bogs, marls, gravels, and other superficial deposits of Europe; but particularly in the shell-marls and peat-bogs (the sites of ancient lakes) in Ireland: hence the name. It is usually, but erroneously, termed *Elk*—the creature being a true deer, though far exceeding in magnitude any living species. Skeletons have been found ten feet high from the ground to the point of the antlers, which are palmated, and often measure from ten to fourteen feet from tip to tip. Chronologically, the Irish deer seems to have been antecedent to man in Europe, though some of the species appear also to have been contemporary with him, and to have been extirpated by the earliest hunter tribes that took possession of its plains and forests.—See Denny in 'Proceedings of York Geolog. Soc.' for 1855.

Irish Diamond.—A frequent term, like "Bristol Diamond," for fine transparent varieties of crystallised quartz or Rock-crystal, which see.

Iron (Gr. *sideros*; Lat. *ferrum*; Fr. *fer*; Ger. *eisen*).—One of the best-known, and, economically speaking, by far the most important of the metals. Though readily tarnished, rusted, or oxidised by exposure to air and moisture, it has in the fresh fracture a peculiar grey colour, known as "iron-grey" or "steel-grey," and, when polished, possesses much lustre. It is not very malleable, but extremely ductile and very tenacious. At common temperatures it is hard and unyielding, but at a red heat it is

IRO

soft and pliable, and at a high red heat two pieces may be inseparably united by hammering—or *welded*, as it is technically termed—into one mass. It is very difficult of fusion, requiring for that purpose the highest heat of the blast-furnace. In this state it can be run into moulds, and is then known as *cast-iron*, which is hard, brittle, and of a granular texture. Subjected to repeated heating and hammering (*puddled*, as it is termed), it becomes less fusible, assumes a fibrous texture, gets tough and malleable, and is then known as *forged* or *wrought iron*. The average specific gravity of cast-iron is 7.27; that of forged, 7.78. Iron is attracted by the magnet, and is itself susceptible of being rendered magnetic—a property possessed by no other metal except nickel. It is capable of forming alloys with several of the metals, though in this state little used; and with a small proportion of combined carbon it forms *steel*, a substance of incalculable importance to all the industrial arts and manufactures.

Unlike many of the other metals, iron is rarely found in a *native* state; and this in scarcely appreciable quantities, in stones and masses of meteoric origin. This *meteoric iron*, as it has been termed, contains nickel, along with cobalt and other metals; and what is known as *telluric iron* occurs in minute grains and scales in other mineral veins, and contains carbon, graphite, or occasionally some other metal, but not nickel. On the whole, *native iron* is a very rare and doubtful substance; and all the iron of commerce is derived from *ores* (oxides, carbonates, &c.) either pure or in combination with various earthy ingredients forming *ironstones*. These ores and ironstones occur in rocks of all ages—the ores chiefly in veins and abnormal masses among metamorphic schists, the ironstones in bands and layers among the strata of the Carboniferous, Oolitic, and other later formations. The ores are usually regarded as belonging to two families—1st, the SPARRY IRON ORES, the most important member of which is *siderite*, *spathose iron*, or *carbonate of iron*, and which includes the *clay ironstones*, or the “clay-bands” and “black-bands” of the Coal and other formations; and 2d, the OXIDISED IRON ORES, embracing such well-known species as *magnetite* or magnetic iron, *hematite* or specular iron, *limonite* or brown iron-ore, and the like. In nature, iron enters largely into the composition of many rocks and rocky compounds; and also forms many chemical combinations, as oxides, carbonates, chromates, phosphates, sulphurets, and sulphates. Its presence in water is readily detected by the tincture of galls, or by the ferro-cyanate of potash—the former turning weak solutions purple or dark-blue, and forming a black precipitate where the metal is more abundant—the latter producing Prussian blue under similar circumstances.—See tabulations, “MINERAL SCHEME.”

Iron-Earth.—A black pulverulent compound of peroxide of iron and protoxide of manganese, occurring in veins of ironstone in the crystalline schists. It attaches itself closely to anything on which it is rubbed, and is strongly attracted by the magnet.

Iron-Flint.—A familiar mineralogical term for some varieties of ferruginous quartz, which see.

Iron Pyrites.—Bi-sulphurets of iron, of which mineralogists distinguish three species.—1. *Pyrite*, yellow sulphuret of iron, or hexahedral iron pyrites; 2. *Marcasite*, white sulphuret of iron, or prismatic iron pyrites; and, 3. *Pyrrhotine*, magnetic iron pyrites, or rhombohedral iron pyrites.

Iron Sinter.—Known also as *pitchy iron ore* or *pittacite*; a recent product, arising apparently from the decomposition of mispickel, and occur-

ring in old mines in reniform or stalactitic brittle crusts of a dark-brown colour and vitreous lustre. It consists of 35 iron protoxide, 26 arsenic acid, 9 sulphuric acid, and 30 water.

Ironstone.—The familiar as well as technical term for the ores of iron, whether occurring in sparry veins like *hematite*, *magnetite*, and *siderite*, or in regular stratified layers like the *clay-bands* and *black-bands* of the Coal-measures. Industrially, it is usual to apply the term to any ore, rock, or matrix that yields an available percentage of iron; though in geology it were advisable to restrict it to ferriferous rocks of sedimentary origin.

Ischnacanthus (Gr. *ischnos*, slender, and *acantha*, spine).—A genus of Acanthodian fishes occurring abundantly in the Lower Old Red Sandstone of Forfarshire, and resembling in general form the smaller species of *diplacanthus*, but differing in having the body longer and more fusiform, the scales smooth, the spines more slender, the teeth larger, the cranial bones covered with granular tubercles, and the eye-orbits larger and more widely apart.

Ischypterus (Gr. *ischys*, strength, and *pteron*, fin).—A genus of ganoid fishes, with smooth rhomboidal scales, from the Triassic strata of Virginia, and so named by Sir P. Egerton from the great size and strength of the fulcral rays of the dorsal fin. They differ from *Palæoniscus*, with which they were first classed, in being less heterocercal, having stronger and more conical teeth, smaller mouth, and scales less ornamented.

Islands (Lat. *insula*).—Occur either singly, when they are said to be *independent*; or in groups or clusters, when they constitute *archipelagos*. They are also distinguished as continental and pelagic—*continental* when their proximity and geological character show them to be dependencies of the continent; and *pelagic* when far off in the ocean they rise up independently, and are generally of volcanic or coralline formation.

Iso (Gr. *isos*, equal).—A prefix denoting *equality* or *similarity*, as *isochronous*, occurring in equal times; *isometrical*, having similar dimensions.

Isocardia (Gr. *isos*, like; *cardia*, the heart).—The heart-codcle; a genus of bivalve shells belonging to the family *Cyprinidae*, and characterised by their large, ventricose, or sub-globular shells; the umbones of which are distant and curved inwards, giving to the shell its peculiar heart-like shape. The living species are few, littoral, and burrowing in sand; the fossil exceed seventy species, and are found in the Trias upwards.

Isocheimal, **Isochiménal** (Gr. *isos*, and *cheima*, winter).—Having the same winter temperature; hence *isocheimal lines* are those drawn through such places as have the same mean winter temperature.

Isóchronous (Gr. *isos*, and *chronos*, time).—Occurring in equal times, or at intervals of the same duration; as the strokes of the pulse, the swing of pendulums of equal lengths, and the like.

Isocrymal (Gr. *isos*, and *krymos*, extreme cold).—Lines laid down on a map or chart to mark the limits of equal extreme cold are termed *isocrymal*, just as those of equal extreme heat are termed *isothermal*.

Iso-dynamic (Gr. *isos*, and *dynamis*, power).—Having the same power or force. Equal in power, and capable of producing the same results.

Isogeothermal (Gr. *isos*; *ge*, the earth; and *therme*, heat).—Applied to lines or divisions in the earth's crust which have the same mean annual temperature; and employed as being more definite than *isothermal*, inasmuch as it refers solely to the land, whereas *isothermal* applies equally to air, land, and water.

Isomerism, Isomérie (Gr. *isos*, and *meros*, part).—Applied in chemistry to express the relation existing between bodies which agree in composition but differ in properties. Isomeric bodies generally agree in the relative proportion of their constituents only, and differ either in the aggregate number of their atoms, or in the manner in which these atoms are arranged.

Isomorphism (Gr. *isos*, and *morphe*, form).—A term employed in chemistry and mineralogy to designate the capability shown by two or more simple or compound substances to crystallise in one and the same form; or often in forms which, though not identical, yet approximate very closely, when it has been named *homœomorphism*. This similarity of form is generally combined with a similarity in other physical properties. The law of isomorphism, as expressed by Mitscherlich, the discoverer of the doctrine, is this:—The same number of atoms combined in the same way produce the same crystalline form; and crystalline form is independent of the chemical nature of the atoms, and determined only by their number and relative position.

Isópoda (Gr. *isos*, and *pous*, *podos*, a foot).—An order of Crustaceans, which, like the *oniscus* or woodlouse, have the trunk divided into seven rings or segments, each segment sustaining a pair of similar unguiculate feet; hence the name. In the *Isopods*, the head or cephalic segment is distinct from the trunk; is furnished with antennæ, and with sessile eyes, which are either composed of clusters of ocelli or compound. Remains of the order (*Archæoniscus*) have been found in the Purbeck beds.

Isopyre (Gr. *isos*, and *pyr*, fire).—An amorphous, brittle, greyish-black mineral, of a vitreous lustre, and slightly magnetic. It occurs in the granites of Cornwall, and in the trap-rocks near Edinburgh; and consists, according to Turner, of 47.09 silica, 13.91 alumina, 15.43 lime, 20.07 iron peroxide, and 1.94 copper oxide. The name refers to the slight change produced on its aspect by fusion.

Isothermal (Gr. *isos*, and *theros*, summer).—Having the same summer temperature; *Isothermal lines*, lines connecting all those places on the surface of the globe which have the same mean summer temperature.

Isothermal (Gr. *isos*, and *therme*, heat).—Having the same temperature; of equal temperature. In physical geography, *Isothermal lines* are lines connecting all those places on the surface of the globe which have the same mean temperature; and as temperature is governed by relative distribution of land and water, by altitude, and other conditions, places on the same parallels of latitude are often on very different isothermal lines.

Ittnerite (after *Ittner*).—A rather rare mineral, occurring in granular aggregates in trap and volcanic rocks, and consisting of silica, alumina, and soda, with lime, sulphuric acid, and water. Allied to *sodalite*, *rosean*, and *haüyne*.

Ivory, Fossil.—The terms "Fossil Ivory" and "Siberian Ivory" are frequently given to the teeth and tusks of the mammoth, which at one time were, and are still, collected in considerable abundance from the plains, shores, and low islands of Siberia. In 1844, it is said that about 16,000 lb. weight of this ivory was obtained from these regions, and of a quality, for the most part, superior to the recent ivory of Africa.

Ixolyte (Gr. *ixos*, glue or birdlime, and *lithos*, stone).—One of the mineral resins, of a hyacinth-red colour, and found in amorphous lumps in the Tertiary lignites of Austria; allied to Hartite. It becomes soft at 169°, and is still viscid at 212° Fahr.; hence its name.

J

Jade.—A hard, tough, siliceo-magnesian rock of a dark leek-green colour, smooth surface, and somewhat soapy feel. It occurs in compact masses, has a coarse, splintery fracture, and is found in various parts of Europe, America, Egypt, China, and New Zealand. It consists chiefly of silica, magnesia, and lime, with a small percentage of iron and alumina, and from its composition is supposed to be a peculiar condition of augite and hornblende. Being tenacious and susceptible of a fine polish, it is worked into amulets, ringstones, chains, and other ornaments. In China it is valued for its supposed medicinal properties in nephritic or kidney diseases, hence the synonyme *nephrite*; and in New Zealand a variety, called by the natives "Poenamu," is fashioned into axes, hangers, idols, &c.: hence also the occasional term *axe-stone*.

Jagged.—Irregularly cut or notched; denticulated or toothed like a saw. Applied to the sharp irregular edges and surfaces of minerals and rock-masses.

Jamb.—A miner's term for any thick mass of rock which prevents them pursuing the lode or vein.

Jamesonite (after Professor Jameson).—Sulphantimonite of lead; an ore consisting principally of the sulphurets of lead and antimony; or, according to analysis, of 43.44 lead, 35.47 antimony, 17.20 sulphur, with traces of copper, zinc, and iron.

Japan Current.—That branch of the equatorial current of the Pacific which trends northward along the Japan coasts, and carries along with it the warm waters of the equator to the North Pacific. In its origin, course, and character, this current greatly resembles the Gulf Stream of the Atlantic, which see.

Jargon or Jargon of Diamond.—A lapidary's term for a Cingalese variety of zircon, colourless specimens of which are often sold for diamonds. Coloured sorts are known as "Matura diamonds," from a district in Ceylon where they occur in worn angular fragments among the river sands.—See ZIRCON.

Jasper (Gr. *jaspis*).—A somewhat loosely-applied term for many siliceous compounds. When quartz is combined with a small proportion of alumina and iron, it loses its transparency and becomes *jasper*, which is consequently tougher or less easily broken. "Jasper," says Nicol, "is coloured red by the peroxide, yellow or brown by the hydrate of iron, but also exhibits many other colours, as green, grey, white, and black, in some kinds alone, in others in spots, veins, and bands—the latter the ribbon or *Egyptian jasper*." It is found abundantly, in veins and bands, in rocks of all ages; and some varieties, as the *porcelain jasper*, are evidently beds of slaty shale, altered by the action of heat. Jasper is susceptible of a fine polish, and is largely manufactured into brooches, bracelets, snuff-boxes, knife-handles, vases, inlaid-work, &c.

Jaspideous, Jaspidean.—Resembling jasper; of the nature of, or containing jasper.

Jeffersonite (after Jefferson).—A variety of augite from Sparta in New Jersey, of a dark olive or black colour, and resinous or semi-metallic lustre.

Jet (*jayet, gagites*, from Gaga, a river in Asia Minor).—This well-known substance is rather a species of amber than coal, and is usually known in Prussia as "black amber." It occurs in nodules and lumps, in lignitic strata; is electric when rubbed; is more resinous in lustre than the finest cannel coal, and is also specifically lighter. Though evidently of vegetable origin, it seldom reveals to the naked eye the woody texture like lignite, but is uniform like asphalt—its intense velvety-black well adapting it for mourning ornaments, as ear-rings, brooches, bracelets, buttons, and the like. It is found in great purity and abundance in the cliffs of alum-shale on the Yorkshire coast; hence the "jet manufactories" of Whitby and Scarborough.

Jigging.—A miner's term for a method of dressing the smaller ores of copper, lead, &c., by the aid of a wire sieve suspended and shaken in a vat of water, so that the smallest particles pass through the sieve, and the larger are "sorted"—that is, the lighter and more earthy remain at the top, and the heavier and more metallic settle below.

Johnsonite (after Professor Johnstone of Durham).—A supersulphide of lead, consisting of 90.38 galena and 8.71 sulphur. It occurs associated with galena in many lead mines, and seems merely a finely granular variety mixed with more or less free sulphur. It is known among miners by the name of "burning galena."

Joints.—The fissures or rents which divide rock-masses into blocks more or less regular are properly so termed. They have been defined as "natural fissures, traversing rocks in straight and well-determined lines, and forming planes of separation which are often slightly open, and which, as they do not merely pass through strata, but through various semi-crystalline aggregations within the stratified mass, were evidently formed since the original accumulation of the strata." This jointed structure appears to have arisen in certain strata from shrinkage or contraction of the deposit while in the process of solidifying; in many instances it is the result of mechanical upheaval and disturbance; while in others the lines of fissure have definite compass-bearings, are arranged in sets, and seem to obey some more general but as yet undetermined law. In basalt and other columnar structures the joints are usually regarded as the results of crystallisation on a large scale. Referring the direction of joints in stratified rocks to lines of upheaval, Professor Sedgwick calls those which run parallel to the strike "strike joints;" those parallel to the dip, "dip joints;" and all others he calls "diagonal joints." It is also customary to speak of "master joints," or those that are regular and run parallel for considerable distances, in contradistinction to "ordinary joints," the former constituting the "backs" and the latter the "cutters" of the quarryman. Again, in mining phraseology the jointings and fissures which accompany sudden flexures (anticlines or saddles, and synclines or troughs) are known respectively as "saddle-joints," or "huckle-joints," and "trough-joints."

Júlcido-Coprolites (Gr. *ioulos*, a catkin, and *eidos*, resemblance).—The name given to the coprolites or fossil excrement of some unknown animal, in allusion to their catkin-like form.

Jumper.—In mining and quarrying, a large iron borer steeled at each end and worked by the hand.

Juncites (Lat. *juncus*, a rush).—Fossil stems and leaves apparently related to the *Juncaceæ* or Rush family, which are chiefly inhabitants of marshy tracts in the temperate and colder regions. Such striated, grooved, and tapering rush-like fragments of leaves occur from the Devonian formation upwards, but their true affinities are not yet determined.

Juniperites (Lat. *juniperus*, the juniper-tree).—The generic term for such fossil coniferæ as are evidently allied to the juniper. Several species occur in Tertiary lignites, and are known by their short, obtuse, broad-based leaves, arranged in four opposite rows round irregularly-forking branches.

Jura Limestone.—A term applied by Continental geologists to the limestones of the Jura Mountains, as equivalent with the Oolite and Lias of English geologists. It is the *Jura-talk* of German geologists.

Jurassic.—A synonyme of the Oolitic system, from the characteristic occurrence of its strata in the Jura Mountains, between France and Switzerland. The Jura beds are composed of limestones of various qualities, sands, sandstones, and thin-bedded clays, and contain the same fossils as those found in the Oolite and Lias of England. Indeed, it is remarked by Sir C. Lyell, "that in the Jura (distant about 400 geographical miles) the analogy to the accepted English type, notwithstanding the thinness or occasional absence of the clays, is more perfect than in Yorkshire or Normandy." There is this difference, however, to be observed, that while the English beds are little altered or disturbed from their original sedimentary character, those of the Jura and the outer ranges of the Alps are often highly indurated and crystalline. Continental geologists are in the habit of dividing the Jurassic formation into three groups—viz., the "White (or Upper) Jura," "Brown (or Middle) Jura," and "Black (or Lower) Jura."—See OOLITIC SYSTEM, and tabulations, "GEOLOGICAL SCHEME."

K

Kaims or Kames.—The name given in Scotland to the elongated and often flat-topped mounds of post-glacial gravel which occur scattered over the lower ends of almost all the great valleys of that country. Known as *eskirs* or *escars* in Ireland, and as *öars* in Sweden, which see.

Kampécaris (Gr. *kampe*, a grub or caterpillar, and *caris*, shrimp).—A small crustacean discovered by the Author in the grey flagstones (Lower Old Red) of Forfarshire, and so named from its appearance. From its imperfect preservation its true affinities cannot be well ascertained—that is, whether a small phyllopod, or the larval stage of some larger crustacean.

Kampylite (Gr. *kampylos*, curved).—An arseniate of lead or variety of *minetite*, occurring with other ores of the metal in hexagonal prisms of a fine orange-yellow, and containing in addition phosphate of lime and traces of chromate of lead. So called from the curved or barrel-shaped form of its crystals.

Kand or Cand.—A familiar term among Cornish miners for fluor-spar.

Kancelstein.—A variety of garnet ranging from hyacinth-red to orange-yellow, and known also as *Hessonite* and *Cinnamon-stone*.

Kangaroo.—A well-known marsupial, the species of which are exclusively restricted to the Australian continent. Remains of more gigantic proportions than any existing species occur in the ossiferous caverns of Australia; and in the earlier Post-Tertiary deposits remains of still larger marsupials (*Diprotodon*, *Zygomaturus*, &c.), apparently allied to the kangaroo, are by no means uncommon.—See **MACROPUS**.

Kaolin (Chin. *Kau-ling*, high-ridge; the name of a hill whence the mineral is obtained).—The name given to the finest porcelain or China clays, arising for the most part from the decomposition of felspar in soft earthy granites. Kaolin occurs in beds and masses, more or less pure, and is generally prepared for use by repeated levigations. The best varieties of this hydrous silicate of alumina are of a white or grey colour, soft and meagre to the touch when dry, and plastic when wet. Their composition is variable; but 48 silica, 39 alumina, and 13 water, may be taken as an available average.

Kapnita.—A variety of calamine or carbonate of zinc, containing more than 15 per cent of iron protoxide. The light-green varieties are generally known as *ferruginous zinc-spar*; and the dark-green, or those which become brown by the oxidation of the iron, as *zinc-iron spar*.

Karoo.—A term applied to the open clayey flats of Southern Africa, which often rise, terrace-like, to considerable elevations, and are hard and steppe-like in the dry season, but in the wet season are speedily transformed into grassy, flower-besplangled plains. The term is thought to be derived from the Hottentot word *Karusa*, signifying "hard," and to refer to the quality of the red clayey soil, which, being impregnated with iron and mixed with sand, becomes hard as burnt clay under the influence of continued drought.

Kárpfolite, Carpholite (Gr. *karpfos*, straw, and *lithos*).—One of the hornblende family, occurring in zeolitic, or fine radiating capillary crystals, of a straw-yellow; hence the name.

Karphosiderite, Carphosiderite (Gr. *karpfos*, straw, and *sideros*, iron).—A straw-coloured mineral occurring in kidney-shaped resinous-looking concretions, resembling iron-sinter; and consisting, according to Harkort, of hydrous phosphate of iron, with a little oxide of zinc.

Karstenite (after Karsten).—Hausmann's synonyme for *anhydrite* or prismatic gypsum.

Kastor and Pollux.—Two minerals of the Felspar family, so named by Breithaupt from their always occurring together. They resemble quartz in their hardness, transparency, and vitreous lustre; and are the most siliceous of the crystalline silicates.

Keene's Cement.—A calcareous cement or plaster now much used in the interior of houses, from its taking a fine polish. "If," says Ansted, "instead of being used with water, plaster-of-Paris in fine powder is thrown into a vessel containing a saturated solution of alum, and after soaking for some time is taken out, rebaked, once more reduced to powder, and then moistened with a solution of alum instead of pure water before use, you have *Keene's Cement*."

Kell.—The same as *reddle* (*ræthel*) or red-clay. An argillaceous peroxide of iron, of a fine deep red, and used for marking.

Kelloway-Rock.—A calcareous or rather calcareo-arenaceous member of

the Middle Oolite, from three to five feet thick, abounding in fossil shells (often entirely made up of them), and so called from its being well developed at Kelloway-bridge, Wiltshire.—See OOLITIC SYSTEM.

Kelp.—The common term for the *crude soda* obtained from the ashes of various *fuci*, and other sea-weeds. It was at one time extensively prepared along the northern coasts of Scotland and Ireland, as well as on the coasts of Holland and France, and used in the preparation of soap, alum, bottle-glass, &c., but is now almost entirely superseded by the soda obtained from sea-salt.—See BARILLA.

Kentish Rag.—A provincial term for a member of the Lower Greensand, consisting of a highly fossiliferous grey cherty or arenaceous limestone, much used for building in Kent and Sussex.

Kent's Hole.—A celebrated ossiferous cavern situated in the Devonian limestone near Torquay, in Devonshire, and which has largely yielded to its explorers remains of mammoth, tichorhine rhinoceros, cave-bear, cave-hyena, and other extinct mammals, associated with flint implements and other evidences of man's contemporaneity with this ancient and now obliterated fauna.—See OSSIFEROUS CAVERNS.

Kerate, Kerargyne (Gr. *keras*, a horn, and *argyron*, silver).—Chloride of silver; horn silver—so called from its cutting like horn. Kerate is generally a recent formation, occurring in the upper part of veins, and on silver that has been buried in the earth, or long immersed in sea-water.

Keratophytes (Gr. *keras*, horn, and *phyton*, a shoot).—An old zoological term for those polypes which have a horny axis like the sea-fans, in contradistinction to the *lithophytes* or true stony corals.

Kermes, Kermesite (*kermes*, the cochineal insect).—One of the ores of antimony (oxy-sulphide), so called from its deep cherry-red colour. It consists, according to Rose, of 75.06 antimony, 4.78 oxygen, and 20.49 sulphur.

Kérolite (Gr. *keros*, wax, *lithos*, stone).—Sesquihydrate of silicate of magnesia, consisting of 46.96 silica, 31.26 magnesia, and 21.22 water, and found in variously-shaped masses in connection with serplutine and other magnesian rocks. It is white or greenish white, has a resinous or waxy lustre, feels greasy, but does not adhere to the tongue.

Keroséne Oil (Gr. *keros*, wax, and *elaion*, oil).—The name given by C. Geesner to a distillation from coals, bitumen, petroleum, or other bituminous minerals, and largely employed for lighting purposes in the United States. The same or closely related to the *paraffine oils* of the British patentees.

Keuper (Ger.)—Literally “copper;” an abbreviated term for the upper member of the Trias, which consists in Germany of variegated cupriferous marls and marl slates, sandstones, gypsum, and carbonaceous slate-clay—making in all a thickness of from 800 to 1000 feet. The Keuper is the equivalent of the saliferous and gypseous shales and sandstones of Cheshire.—See TRIASSIC SYSTEM.

Kibble.—In mining, a bucket, usually of iron, in which ore is drawn to the surface.

Kidney-Iron-ore.—A familiar term for those varieties of hæmatite which occur in reniform or kidney-shaped concretions.

Kieselguhr (Ger.)—Literally “flint-fermentation;” the German term for the bergmahl or mountain-meal of Lapland, which resembles a siliceous paste or yeast, and consists chiefly of the siliceous shields of diatomacææ.

Kilkenny Coal.—A name occasionally given to anthracite, from its occurring at Kilkenny in Ireland.—See ANTHRACITE.

Killas.—A Cornish name for a coarse argillaceous schist, or clay-slate, in which many of the metalliferous veins in that county and Devonshire occur.

Killinite.—A greenish grey or yellowish mineral, belonging to the Felspar family, and supposed by some to be only a decomposed *spodumene*, with which it occurs in the granite at Killiney, near Dublin.

Kim-Coal.—A provincial term for a highly bituminous shale occurring in the Oolitic beds at Kimmeridge. This shale has been locally used as an inferior coal, and attempts have been made to distil from it naphtha, paraffine, and other analogous products. Sir C. Lyell is inclined to believe that its bitumen is partly of vegetable and partly of animal origin.

Kimmeridge Clay.—A member of the Upper Oolite, consisting of thick beds of bluish-grey slaty clay, and in great part of a bituminous shale, which sometimes forms an impure coal (*Kim-Coal*). The group is well developed at Kimmeridge in the isle of Purbeck, Dorsetshire; hence the name. It is also largely developed and highly fossiliferous near Hartwell, in the vale of Aylesbury, Buckinghamshire.

King-Crab.—Known also as the "horse-shoe crab," from the shape of its carapace or shield; the *Limulus* of systematic zoology, which see.

Kirkdale Cave.—A celebrated cavern occurring in the Coralline Oolite at Kirkdale, about twenty-five miles N.N.E. of York, and remarkable for the variety as well as abundance of bones found imbedded in the calcareous mud that overspreads its floor.—See OSSIFEROUS CAVERNS.

Kirwanite (after Richard Kirwan of Dublin, a distinguished mineralogist of the last century).—A mineral nearly allied to prehnite, of a dark olive green, and occurring in spheroidal masses, with a radiating fibrous texture in basalt in the Mourne Mountains, Ireland. Probably a variety of *Green Earth*.

Kitchen-Middens.—The shell-mounds or *Kjökken-møddings* of Denmark and other northern shores, which see.

Kivi-Kivi.—The native name for the *Apteryx*, or wingless bird of New Zealand, sub-fossil congeners of which have been found in the river-silts of that country.—See APTERYX.

Kjökken-Mødding (Dan.)—Literally "Kitchen-middens;" the name given by the Danes to certain mounds which occur along their sea-coasts, and which consist chiefly of the castaway shells of the oyster, cockle, periwinkle, and other edible kinds of shell-fish. These mounds, which have also been found on the shores of Moray and the north of Scotland, are from 3 to 10 feet high, and from 100 to 1000 feet in their longest diameter. They greatly resemble heaps of shells formed by the Red Indians, along the eastern shores of the United States, before these tribes were extirpated. The "Kitchen-middens" of Europe are ascribed by archæologists to an early people unacquainted with the use of metal, as all the implements found in them are of stone, horn, bone, or wood, with fragments of rude pottery and traces of wood-fires. All the bones yet found are those of wild animals, with the exception perhaps of the dog, which seems to have been domesticated.

Klaprothine (after Klaproth the chemist).—Same as Azurite, Prismatic Azure-spar, or *Lazulit*, which see.

Kleyn Spawen or Lîmburg Beds.—An important group of highly fossil-

iferous strata belonging to the Upper Eocene or Lower Miocene epoch. They consist of sands, clays, and marls of marine or fluvio-marine origin, and are the equivalents of the Hempstead beds in the Isle of Wight.

Knebellite.—A mineral of a grey, green, or reddish-brown colour, apparently a variety of olivine, and consisting of about equal parts of silica, iron protoxide, and manganese.

Knórria (after Knorr).—A genus of Coal-measure plants, embracing those stems the leaves of which were densely arranged in spiral manner, and left *projecting* instead of depressed leaf-scars. They are usually ranked as *Lycopoda*, but seem intermediate between them and the *Coniferæ*.—See **HALONIA**.

Kobellite (after Von Kobell).—Sulphobismuthate of lead; an ore occurring in the cobalt-mines of Sweden, of a dark lead-grey like grey antimony, but with a brighter lustre; soft; with a radiated structure.

Koessen Beds.—Known also as the "Upper St Cassian Beds," from their occurrence at St Cassian in the Austrian Alps; a series of grey and black limestone with calcareous marls, by some regarded as Upper Triassic and by others as Lower Liassic. They contain abundantly *Avicula contorta*, *Cardium Rhaeticum*, &c., and are supposed to represent the bone bed of Swabia.—See **RHAETIC BEDS** and **AVICULA CONTORTA ZONE**.

Koninckia.—In honour of M. De Koninck; a genus of brachiopods belonging to the *Orthida*, and characteristic of the St Cassian or Upper Triassic beds of the Austrian Alps. The shell is distinguished by its smooth, round, concavo-convex valves; incurred beak destitute of hinge area and foramen; and by the four-coiled spiral furrows which mark either valve and were once occupied by the arms.

Keth.—A name given by the Spaniards to an earthy slimy substance ejected from the volcanoes of South America. It is of a blackish-brown colour; has an earthy texture; and is but slightly coherent. Known also as *Moya* and *Canagua*.

Könlite, Könlinité.—One of the hydro-carbons (92.43 carbon, 7.57 hydrogen) occurring in thin white plates and scales in the Brown Coals of Germany, and resembling *Scheererite*.

Koupholite (Gr. *kouphos*, light, and *lithos*).—A term used by Lametheric for *Prehnite*, which see.

Krantzite (after Dr Krantz of Bonn).—A fossil resin of a yellowish-brown or dark-brown colour, occurring in grains and roundish pieces in the Brown Coals of Germany; somewhat elastic; sectile; fuses at 437° Fahr., and at 572° distils over a brownish oil having a very disagreeable and penetrating odour.

Kryolite; more commonly **Cryolite**, which see.

Kulock or Kahloch, near Rabenstein in Franconia, on the bank of the Esbach, celebrated for its remarkable ossiferous cave.—See **OSSIFERUS CAVERNS**.

Kunkur.—A Hindostanee term for a superficial accumulation, which in point of time seems to correspond pretty well with the Drift or Boulder-Clay of Europe. "It is compact," says Ansted, "often nodular or tufaceous, and frequently small-concretionary; of light-brown, reddish, or ash-grey colour; and rarely fossiliferous. In its composition it is chiefly calcareous, containing about 72 per cent of carbonate of lime, and 15 per cent of silica, with 18 per cent of alumina. It spreads over a very large proportion of India and the adjoining countries, being more especially abundant

in the line of country running up from Guzerat to the north-east, towards Delhi. It is constantly observed, not only occupying the low ground, but reposing under the vegetable soil of the elevated plains and plateaux of Central India, and even on the summits of hills between 2000 and 3000 feet above the level of the sea." Kunkur deposits are sometimes 60 and 70 feet thick, and seem, according to Captain Newbold, to have arisen from calcareous springs. All the lime of the Punjaub is derived from the Kunkur.

Kupfer-Nickel (Ger.)—Copper-nickel, prismatic nickel pyrites, or *Nickeline*, which see. It consists of arsenic and nickel, with sulphur, traces of cobalt, iron, lead, &c., and is used as an ore of nickel, and in the manufacture of German silver.

Kupfer-Schiefer (Ger.)—Literally copper-slate; a dark bituminous-looking slaty marl-stone, associated with the Zechstein (mine-stone) of Germany, and richly impregnated with copper-pyrites, for which it is extensively worked. It is the equivalent of the magnesian marl-slates (Lower Permian) of Durham, &c., and abounds in finely-preserved fishes—*paleoniscus*, *pygopterus*, *platysomus*, &c.—peculiar to that formation.

Kyanite.—Same as *Cyanite*, which see.

Kyson Sands.—A bed of Eocene sand, occurring at Kyson or Kingston, a few miles east of Woodbridge in Suffolk, and celebrated for its yielding the remains of the monkey tribe—*Macacus eocanus* of Owen.

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Labradorite.—Called also *opalescent felspar*, or *Labrador felspar*, from the locality where first found; a variety of disseminated felspar having a peculiar pearly and iridescent play of colours when the light falls on it in certain directions. Bonsdorff ascribes this property to an excess of silica; Haidinger affirms that the play of colours proceeds from certain regularly-defined points. Labradorite is a soda-lime felspar, and occurs most abundantly as a constituent of rocks; when found in crystals or in veins it takes a fine polish, and is used as an ornamental stone.

Labyrinthodon (Gr. *labyrinthos*, a place full of intricate passages, and *odous*, tooth).—A name given by Professor Owen to a batrachian reptile of the New Red Sandstone, in allusion to the labyrinthine structure exhibited by sections of its teeth. No complete skeleton of the labyrinthodon has yet been discovered, but it is supposed to be one and the same with the *Cheirotherium*, the hand-like impressions of whose feet are so frequent on the slabs of the New Red Sandstone formation. The Labyrinthodont saurians, described at different times under the names *Cheirotherium*, *Mastodonsaurus*, *Salamandroides*, and *Phytosaurus*, are all referred by Owen to the genus Labyrinthodon, and appear to range from the Devonian to the Triassic inclusive.

Labyrinthodontia (Gr. *labyrinthos*, a labyrinth, and *odous*, tooth).—One of the thirteen orders into which Professor Owen proposes to arrange the

Reptilia, living and extinct. The name refers to the complex structure characterising the teeth in the several genera of the order, the complications being produced by undulations and side-branches of the converging folds of cement. As in the *Ganocephala* (which see), the head is defended by a continuous casque of externally sculptured and usually hard and polished osseous plates; there are two occipital condyles; the vomer is divided and is denticulous; there are two external nostrils; the vertebral centres, as well as arches, are ossified and are biconcave; the pleurapophyses of the trunk are long and bent; the limbs ambulatory, and the hinder large in proportion. The order embraces such genera as *Labyrinthodon*, *Mastodonsaurus*, *Capitosaurus*, &c., all founded on minor modifications of the skull, teeth, scutes, &c.

Lacertian, Lacertilian (Lat. *lacerta*, a lizard).—Belonging to or resembling the Lacertinidae or Lizard family, a well-known group of saurian reptiles, recent and fossil. In Owen's arrangement of the Reptiles, the Lacertilia constitute his tenth order; and are specialised as having procelian vertebrae, with a single transverse process on each side, and with single-headed ribs; the sacral vertebrae not exceeding two. The order seems to range from the Wealden to the present day, and includes such fossil forms as *Coniosaurus*, *Dolichosaurus*, *Mosesaurus*, &c., the head of the latter being fully five feet long.

Lacustrine, Lacustral (Lat. *lacus*, a lake).—Of or belonging to a lake; as "lacustrine deposits," that is, deposits which have been accumulated in fresh-water areas, as lakes and marshes. They usually consist of mud, sand, clay, marl (fresh-water limestone), peat-moss, and the like, and contain the remains of aquatic plants and animals, mingled less or more with those of land species.—See LAKES.

Leomodipoda (Gr. *laimos*, the throat; *dis*, two; and *pous, podos*, foot).—A family of crustaceans, thus named because they have the anterior pair of feet placed under the head, as though at the throat—the first segment of the trunk, which carries these feet, being conjoined with that of the head; e.g., the *cyamus*, or whale-louse. In the Leomodipods the eyes are sessile; the posterior part of the body is little developed; they do not swim, but creep on marine plants and animals in search of food; and in most (says Van der Hoeven) the feet are wanting in those rings that carry gill-vesicles, and conversely the gill-vesicles are wanting on those rings that have feet.

Lágomys (Gr. *lagos*, hare, and *mus*, rat).—Literally, "hare-rat;" the *Pika* of Siberia; a small tailless rodent forming a link between the hare and the rat, and occurring only in the northern regions of Asia and America. Several species have been found fossil in the ossiferous caverns and breccia, as well as in the ancient lacustrine deposits of Europe.

Lagoon, Lagúne (Ital. *laguna*).—Generally applied, as in the Adriatic, to shallow salt-water lakes or sheets of water cut off (or nearly so) from the sea by intervening strips of beach or river-deposit; also to the waters enclosed by circular coral-reefs; as well as to the lake-like sheets that frequently occur in tidal and periodically inundated deltas.

Lake (Lat. *lacus*).—The general term for any inland body of water not connected with the ocean or any of its branches. Lakes occur in depressions of the earth's surface more or less below the level of the surrounding country, and, generally speaking, have a tendency to become shallower, both from the silt that is carried into them by their feeding streams, and

from the gradual deepening of the river-channel which forms their natural drainage. This tendency being continued, they, in process of time, become silted up, drained, and converted into tracts of alluvial land; hence it may be laid down as a geological axiom that in all long-established continents and islands lakes are now shallower, smaller, and fewer than in former ages. In the Current as well as in the Tertiary epoch we have abundant evidence of such obliterations; the formations arising from lake-silt (lacustrine deposits) being characterised by peculiarities lithological and paleontological which separate them in a marked manner from marine sediments. These peculiarities are, tranquillity of deposition, absence of littoral action, the remains of fresh-water plants and animals, with a greater admixture of terrestrial organisms; and with these as guides there is little difficulty in determining lacustrine from estuary or oceanic deposits. Existing lakes are usually divided into *four* kinds—viz., 1. Those that have neither outlet nor inlet—subterranean springs and rains supplying the water, and evaporation carrying off the excess. These are usually small mountain-lakes or *tarns*, and the craters of extinct volcanoes. 2. Those which have an outlet, but receive no running water, being fed by springs rising from their bottoms and rocky margins. Lakes of this class are also small and situated in mountainous regions. 3. Those which both receive and discharge streams of running water, and which form alike the most numerous and most extensive in both hemispheres. 4. Those which, like the Caspian, &c., receive streams of running water, but have no visible outlet—the balance of level being maintained by evaporation. Such lakes are more or less impregnated with saline matter; and their saltiness must be on the increase.

Lake-Basin.—In geography, the depressed area which contains the waters of a lake; also the entire area drained by the streams that fall into a lake. In geology, the concavity or basin-shaped hollow in which the waters of a lake rest, and which in some instances has arisen from an original depression of the surface, in others from a damming up of valleys by cross mounds of debris, such as moraines, &c., and in some again from excavations that have been scooped out by the forcible and long-continued pressure of glaciers and analogous ice-masses.

Lake-Dwellings.—The name given by archaeologists and geologists to the remains of dwellings now found in marshes and lake-silts, and which seem to have been erected on piles driven in the water, or on mounds partly formed of stones, wood, and other debris. These lake-dwellings have been found in Switzerland, Ireland, Scotland, and other countries of Europe, and point to a time when the early inhabitants betook themselves to this style of habitation for purposes of defence and protection. In some instances, as in Switzerland, the piled area is of considerable extent (forming an aquatic village as it were) and connected with the shore by a piled way or causeway. Known in Ireland as *Crannoges*, and in Switzerland as *Pfahlbauten*, which see.

Lamantin.—The manatus, manatee, or sea-cow; an herbivorous cetacean, inhabiting the mouths of tropical rivers in Africa and South America. Fossil species occur in the Miocene and Pliocene Tertiaries of Europe.

Lamellar, Lamellated (Lat. *lamella*, diminutive of *lamina*, a little plate).—Composed of very thin plates or scales; foliated; in paper-like leaves, as talc, mica, the oyster-shell, &c.

Laméllibranchiata (*lamella*, a little plate, and *branchia*, the gills).—

Blainville's term for the *Conchifera*, a class of bivalve shell-fish which, like the oysters, scallops, mussels, and cockles, respire by membranous or leaf-like gills attached to the mantle.—See CONCHIFERA.

Lamina, plur. **Laminae**.—The Latin term for any thin leaf-like plate, as of metal. Many stratified rocks split up into thin layers or *laminae*; hence the terms *laminated*, *laminar*, &c.

Laminarian Zone (*laminaria*, the sea-tangle).—That zone or belt of marine life which commences at low-water mark, and extends to a depth from forty to ninety feet, and in British seas is characterised, as its name implies, by the broad waving sea-tangle and larger algæ, by star-fishes, the common echinus, by tubularia, modiola, and pullastra.—See ZONE.

Laminarites (*laminaria*, the broad sea-tangle).—A term applied by Brongniart to the broad-leaved fossil algæ of the Upper, Secondary, and Tertiary formations.

Laminated (Lat *lamina*, a thin plate).—Applied to strata splitting up into thin layers, as certain flagstones and tilestones, which occasionally exhibit from twenty to thirty laminae in the thickness of a single inch—each *lamina* being the result of an independent deposit in tranquil waters.

Lamination (Lat. *lamina*, a plate or layer).—Arrangement in layers. Lamination prevails less or more in all sedimentary deposits, and is, for the most part, parallel to the lines of bedding or stratification; *oblique lamination* or *false bedding* occurs, however, in many coarse thick-bedded sandstones, and seems as if the material composing the stratum had been carried forward by currents into deep water, and laid mass after mass on the sloping edge of the advancing deposit.

Lamna (Gr., a plate of metal).—A genus of sharks whose thin, sharp, plate-like teeth occur abundantly in the Chalk and Tertiary formations. These teeth are rather flat, sharp-pointed, with smooth trenchant edges, and a small sharp denticle (or little tooth) on either side the base.

Lanarkite.—Sulphate and carbonate of lead, occurring either massive or in long, slender, right-rhombic prisms, of a greenish-white or grey colour, sectile, and in thin laminae flexible like gypsum. First found at Leadhills in Lanarkshire, hence the name.

Lanceolate, Lanciform (Lat. *lancea*, a lance or spear).—Lance-shaped; narrow and tapering like the leaves of many plants; e.g., the common ribwort.

Landes (Fr.).—Literally, *heaths*; but applied in particular by French writers to those extensive areas of sand-drift which stretch southward from the mouth of the Garonne along the Bay of Biscay, and inwards towards Bourdeaux—hence often spoken of as the “Landes de Bourdeaux.” They are extensively planted with the sea-pine (*Pinus maritimus*) on the seaward side, but stretch away inland in heathy undulating plains, chiefly occupied as sheep-runs.

Land-Locked.—Applied to seas that are isolated from the rest of the ocean by peninsulas and chains of islands, as the Sea of Japan, the Sea of Okhotsk, &c. *Land-locked* seas are thus only partially enclosed or locked in by the land, while *inland* seas are surrounded on all sides by the land in a continuous manner, as the Baltic and Mediterranean.

Landslip.—Any portion of land that has slid down in consequence of some undermining or disturbing action. Landslips, as might be expected, are most frequent in districts subjected to earthquake disturbance, and there they sometimes take place on such a scale as materially to affect the

surface configuration of the country. They also occur extensively in steep mountainous regions like the Alps and Himalayas, especially on the breaking up of the winter's frosts, when large masses of the cliffs and mountainsides, losing their cohesion, are precipitated into the valleys and river-courses below, with all their burden of soil, shrubs, and trees. In our own country they are sometimes occasioned by the undermining action of the waves, and not unfrequently, after heavy rains, by the softening of sub-jacent clayey beds where the strata are considerably inclined. For examples see Lyell's 'Principles.'

Langite (after Prof. Victor Von Lang).—A basic sulphate of copper occurring as an incrustation upon the very soft *Killas* slate of Cornwall, in masses of a rich blue colour, and accompanied by crystals belonging to the prismatic system. According to Professor Maskelyne, who first described it, *Langite* differs from common sulphate of copper in being insoluble in water.

Laniary, Laniárriform (Lat. *lanio*, I cut or tear).—Applied to the canine or cutting teeth of the Carnivora, in reference to their function.

Lanthánium, Lánthanum (Gr. *lanthano*, I conceal).—A rare metal, discovered by Mossander, associated with didymium in the oxide of cerium, and so named from its properties being *concealed*, as it were, by those of *Cerium*, which see.

Láophis (Gr. *laas*, rock, and *ophis*, serpent).—A Tertiary serpent, the detached vertebrae of which, according to Owen, indicate a length of ten or twelve feet, and present some affinities to those of the rattlesnake.

Lapidify, Lapidification (Lat. *lapis*, a stone, and *fió*, I become).—Conversion into stone; the process by which soft, loose, or incohering substances, organic or inorganic, are converted into stony matter.

Lapilli (Lat. *lapillus*, a little stone).—Applied to a peculiar variety of volcanic cinders, or small slaggy concretions.

Lapis (Lat.).—A general term for any kind of stone; as *lapis ollaris*, potstone; *lapis lazuli*, ultramarine; *lapis ætites*, eaglestone; *lapis ampelides* jet or cannel-coal, &c.

Lapis Láuli.—A well-known mineral of an ultramarine or fine azure-blue colour, of various intensity. It is generally found massive and disseminated; of a finely granular or compact texture; and so hard as to scratch glass. It varies considerably in composition, but on the whole may be said to consist of about 50 silica, 11 alumina, and 16 lime, with minor proportions of sulphuric acid, iron peroxide, magnesia, and sulphur. The depth of its colour seems to depend on the amount of iron and sulphur. It is found chiefly in crystalline limestone, but occurs also in the granitic and crystalline rocks. The finest specimens are obtained from China and Central Asia. It is used as an ornamental stone when sufficiently large and pure; but chiefly in the preparation of the fine pigment called *ultramarine*, which see.

Láridæ (Lat. *larus*, the sea-gull).—The Gull family, which includes the gulls, terns, petrels, and other well-known marine *Natatores*, or swimming-birds. The bones of allied species have been discovered in Post-tertiary and Tertiary strata; e.g., *halcyornis*, *pelagornis*, &c.

Larva (Lat., a mask).—Properly, an insect in its grub, caterpillar, or maggot state, before it has attained its winged or perfect condition. **Larval.**—Applied to the embryotic stage of crustacea and other animals which undergo metamorphoses in their development, as well as to the grubs of insects.

Lasionite.—A phosphate of alumina, better known as *Devonite* and *Wavellite*, the latter of which see.

Lâterite (Lat. *later*, a brick).—Literally “brick-stone;” a compound of clay (silicate of alumina) and oxide of iron, often arising from the decomposition of trap and volcanic rocks. The term is most frequently applied, however, to a peculiar clayey deposit of Middle Tertiary age, found in India, and so named from being cut into bricks and used for building. “It varies much,” says Ansted, “in colour and composition, but generally consists of a reddish-brown or brick-coloured cellular clay, more or less indurated, and used by the natives as bricks when cut square. It hardens greatly and permanently on exposure, and is well adapted for buildings and fortifications.” Portions of the deposit, however, pass into hard, compact jaspideous rock on the one hand, or into loosely-aggregated grits and soft ochrey clays on the other.

Latitude (Lat. *latitudo*, breadth).—The latitude of a place on the earth's surface is its distance from the equator, measured in degrees, minutes, and seconds along its own meridian. If in the northern hemisphere, it is said to be in North Latitude (N. Lat.); and if in the southern, in South Latitude (S. Lat.) As the distance between the equator and either of the poles is only the fourth part of the earth's circumference, or 90°, the latitude of a place can never exceed that amount. *Parallels of latitude* are small circles drawn parallel to the equator; and in each such circle every place has, of course, the same latitude. The terms *longitude* and *latitude* arose from a notion of the ancients that the earth was longer from east to west than from south to north; in other words, that it had *length* and *breadth*, which these terms express.

Lâtrobite (after M. Latrobe).—A pink or rose-red mineral, allied to felspar, and occurring in indistinct crystals or massive, associated with felspar, mica, and calc-spar.

Laumonite (after M. de Laumont).—One of the zeolites, occurring in druses in the trap-rocks, and known also as *efflorescent zeolite*, because, when exposed to the air, it loses its lustre and transparency, and is decomposed.

Laurentian, Laurentian System.—The term employed by Sir W. Logan, of the Canadian Geological Survey, to designate the highly crystalline sedimentary strata which belong especially to the valley of the St Lawrence, and constitute the Laurentide Mountains, the equivalents of the “Older Metamorphic” strata of Europe. “The rocks of this system,” says Sir William, “are, almost without exception, ancient sedimentary strata which have become highly crystalline. They have been very much disturbed, and form ranges of hills having a direction nearly north-east and south-west, rising to the height of 2000 or 3000 feet, and even higher. The rocks of this formation are the most ancient known on the American continent, and correspond, probably, to the oldest gneiss of Finland and Scandinavia, and to some similar rocks in the north of Scotland. They consist, in great part, of crystalline schists (chiefly gneissoid or hornblende), associated with felspars, quartzites, and limestones, and are largely broken up by granites, syenites, and diorites, which form important intrusive masses. Among the economic minerals of the formation, the ores of iron are the most important, and are generally found associated with limestones.” The total thickness of the system has been estimated at 23,000 feet.—See tabulations, “GEOLOGICAL SCHEME.”

LAV — LEA

Lava (Ital.)—The general term for all rock-matter that flows in a molten state from volcanoes, and which, when cooled down, forms varieties of tufa, trachyte, trachytic greenstone, and basalt, according to the varying proportions of felspar, hornblende, augite, &c., which enter into the composition of the mass; and according to the slowness or rapidity with which it is cooled. The more rapid the process of cooling, the more compact the rock; and thus we have among Volcanic products, just as among the older igneous rocks, every variety of texture, from that of a glassy basalt to a granular trachyte or *greystone*, and from that to a soft earthy tufa or light vesicular pumice. The rocks known as *obsidian*, *pumice*, *scoria*, &c., are therefore mere varieties of lava or volcanic rock-matter. Respecting the temperature, liquidity, rate of cooling, and other conditions of newly-ejected lava, we have no very certain data, nor is it likely that any two eruptions will exactly coincide in any of these particulars. This much, however, we know, that while some lavas are sufficiently hot to melt fragments of rocks thrown into their current, others are so little above the melting-point that they are covered with a stony crust almost immediately on their exposure to the open air. Again, some are so liquid as to penetrate the fibres of wood, while others are so viscid that their flow is scarcely perceptible. The rate of cooling also depends on many correlative circumstances; and while the lava of Mauna Loa was covered with a crust which could be walked upon in a few days after eruption, that of Vesuvius has been known to remain red-hot for years at a few feet beneath the surface.

Lazulite (Arabic, *azul*, sky-blue).—A mineral of a light-blue colour, known also as *azurite* and *prismatic azure-spar*. It is usually massive or disseminated in granular aggregations, and consists of a hydrous combination of phosphate of alumina and phosphate of magnesia, with protoxide of iron. Distinct from *Lapis-lazuli*, which it faintly resembles only in colour.

Lead.—A well-known metal of a bluish-grey colour; soft, flexible, and inelastic; and though ductile and malleable, yet possessed of very little tenacity. Its specific gravity varies from 11.3 to 11.4; its hardness is 1.5; and it fuses at a temperature of about 600° Fahr. In close vessels it does not appear to be volatile at a white heat, but melted in open vessels it soon oxidises and passes into a grey powder, which, upon further exposure to heat and air, becomes yellow, and is called *massicot* or *protoxide of lead*. If massicot be heated, and stirred to prevent fusion, it gradually absorbs oxygen, acquires a red colour, and is called *red-lead*; and this red-lead, heated in nitric acid, is partly converted into a brown insoluble powder which is a *peroxide of lead*. By treating these oxides with acids we obtain *white-lead* or *carbonate of lead*, and *sugar of lead* or *acetate of lead*—preparations extensively used in the arts and in pharmacy. Lead is rarely found *native*, and that chiefly in volcanic rocks, where it appears as a product of fusion. Commercially, it is wholly obtained from the *ores*, and these occur in rocks and formations of all ages—almost always in veins, as in the metamorphic schists and carboniferous limestones of our own country. One of the most abundant and best known of its ores is *Galena*—*sulphuret of lead* or *lead-glance*—which has been taken as the representative of the LEAD-GLANCE FAMILY; of less importance commercially, but of great mineralogical interest, occur the LEAD-SALTS FAMILY, which are usually associated with the former in crystalline forms less or more distinct.—See tabulations, "MINERAL SCHEME," for the species included under these respective families.

Lead, Black.—Known also as *Plumbago*, and technically and more properly as *Graphite*, which see.

Lead-Glance.—An early and familiar term for the sulphuret of lead or *Galena*, which see.

Leadhillite.—A sulphato-tri-carbonate of lead, occurring in tabular crystals, or in foliated aggregates; and so called from its being first found among the usual ores of Leadhills in Scotland.

Lead-Ochre.—A massive, opaque, sulphur-yellow oxide of lead, occurring among volcanic products, but in other respects similar to the artificial yellow oxide.

Lead-Spar.—The carbonate of lead, or *Cerussite*. **Red-Lead Spar.**—The chromate of lead or *Crocoisite*, both of which see.

Leaia (After Dr J. Lea of Philadelphia).—A genus of small bivalved entomostraca from the Carboniferous formations of Europe and America, characterised by their dark-coloured, thin, horny, quadrangular valves, either lying separate or with their dorsal edges approximate, and marked with concentric furrows, running parallel with the three sides of the valves, and by two oblique transverse ridges crossing the valve, from the umbo to the ventral angles. Sometimes confounded with *Estheria* and *Cypriocardia*.

Lecanite (After Dr J. Le Conte).—Sulphate of soda and ammonia, with much water of crystallisation; a substance occurring in rhombic crystals, clear and colourless when free from extraneous matter, and of a bitter saline taste. It was first discovered by Dr John Le Conte in a cave in Honduras, in a black bituminous-looking matrix, considered to be the decomposed excrement of bats, which infest these caverns in vast numbers, and have likely inhabited them for ages. The caves in which this substance occurs are worked out for nitre.

Léelite.—A species, or rather a variety, of compact felspar, of a reddish colour, waxy texture, and horn-like translucency; found at Gryphyttan in Westmannia, and so named after Dr Lee of Cambridge.

Leeward.—A nautical term of frequent occurrence in geographical descriptions. In sailing, that side of a ship against which the wind blows is called her *weather-side*, while the opposite one is known as the *lee-side*. All objects on the weather-side are said to be to the *windward*, and those on the lee-side to be to the *leeward* of the vessel.

Legion (Lat.).—Literally “a gathering or group.” A term occasionally used in natural history classification to express an assemblage of objects intermediate in extent between a *class* and *order*. A class may thus embrace several legions, and a legion contain many orders.

Leguminosites (Lat. *legumen*, a pod).—Fossils occurring chiefly in Tertiary strata, and apparently the seeds of pod-bearing plants. About twenty species from the London Clay have been enumerated by Dr Bowerbank.

Lehm.—An ancient alluvium of the Rhine, better known as Loess, which see.

Leiacanthus (Gr. *leios*, smooth, and *acantha*, a spine).—Literally “smooth spine;” a provisional genus of fossil fishes, the ichthyodorulites or fin-spines of which are found in the Muschelkalk.

Léiodon (Gr. *leios*, smooth; and *odous*, *odontos*, tooth).—A generic name given to certain smooth mosasauroid teeth from the Chalk formations, in order to separate them provisionally from *Mosasaurus* proper, under which they were at one time included.

Lemnian Earth.—A variety of clay or aluminous earth, so called from the island of Lemnos in the *Ægean Sea*. It is of a yellowish-grey or white, with ochreous spots on the surface; has a meagre feel; adheres slightly to the tongue; falls to powder in water; and, according to some, seems to be only a decomposed trachyte. It has been used as a medicine from the time of Homer, and is sometimes termed *sphragide* (*sphragis*, a seal) or *terra-sigillata* from its being made up in cakes and stamped for the market. This earth, like the "*Armenian Bole*," has been the subject of innumerable fables and traditions. When Vulcan was hurled from heaven and fell on Lemnos, it stopped the bleeding of his wounds and bruises; subsequently it was used not only to stop bleedings, but as an antidote to poisons and the plague; and, from its reputation, has been greatly valued by all the successive possessors of the island, Greeks, Christians, and Mohammedans. Hence also the various stamps which it has successively borne—Diana, Vulcan, the Seal of the Grand Signor, and that of a goat, from the practice of working up the smaller and friable portions into a cake with goat's blood. If it has any medicinal properties, it is merely as an aluminous astringent.

Lemnian Reddle.—An ochre of a deep-red colour and firm consistence, occurring in conjunction with the *Lemnian Earth*, and used as a pigment.

Lenticular (Lat. *lens*, a lentil).—Resembling a lentil; having the form of a lens. Hence we speak of "lenticular concretions," "lenticular pebbles," &c.

Léxinite.—One of the Clay family; a milk-white variety of *Halloysite* or semi-translucent silicate of alumina, consisting of 37.5 silica, 27.5 alumina, and 25 water, and named after Lenzins, a German mineralogist.

Leonina.—A rare variety of agate, of a pale-yellow colour, variegated with white, black, and green, and bearing some resemblance to a lion's skin; whence the name.

Lepadites.—A term occasionally applied to fossil shells, apparently those of the goose-barnacle (*lepas*), as *balanites* is sometimes applied to those of the *balanus* or acorn-barnacle. The term has also been used to designate those bivalvular shell-like organisms, better known as *solanites*, *aptychus*, and *trigonellites*, the last of which see.

Lepidodendron (Gr. *lepis*, *lepidos*, a scale, and *dendron*, tree).—An abundant family of fossil plants, so called from the scale-like arrangement of the leaf-scars that adorn their stems. They are characteristic of the Upper Palæozoic strata, and especially of the Carboniferous system, in which they figure as one of the prevailing vegetable forms. They occur of all sizes, from mere twigs and branchlets to stems more than fifty feet in length, and often from three to five feet in breadth. A great number of species have been recorded, but many of these must in the mean time be regarded as uncertain and provisional. As regards the affinities of the family, botanists are by no means agreed, and it is more than likely that the *Lepidodendron*, like many other fossil plants, has no existing analogues. Thus, in the arrangement of their leaf-scars they resemble both the *Conifera* and *Lycopods*; in their foliage they more resemble the *Conifers*; in their dichotomous ramification they are more like the *Lycopods*; while in their texture and size they seem more akin to the *Conifera*. "On the whole," says Professor Lindley, "we are led to conclude that the *Lepidodendron* genus was not exactly like either *Conifera* or *Lycopodiaceae*, but that it occupied an intermediate station between those two orders,

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approaching more nearly to the latter than to the former." On the other hand, M. Brongniart, Dr Joseph Hooker, and other eminent botanists, concur in regarding them as gigantic arborescent club-mosses, of which *Lepidophyllum* was the leaf, and *Lepidostrobus* the fruit. From a minute examination of the cones (*Lepidostrobus*), Professor Schimper considers the genus more nearly allied to *Selaginella* than to *Lycopodium*.

Lepidoganoïd, Lepidoganoïdæ (Gr. *lepis*, *lepidos*, a scale, and *ganos*, splendour).—A sub-order of the Ganoid fishes, and so termed in contradistinction to the *Placoganoïds*, because their external skeleton or covering consists of *scales*, whereas that of the latter consists mainly of large and often reticulated *plates*. The Lepidoganoïds are more especially characteristic of the Upper Palæozoic strata, the Placoganoïds of the Lower or Devonian.—See **PLACOGANOÏD**.

Lepidoidæ, Lepidoids (Gr. *lepis*, a scale, and *eidōs*, resemblance).—A family of Ganoid fishes, characterised by their strong rhomboidal bony scales, and occurring in Carboniferous, Triassic, and Oolitic strata, but most abundantly in the latter. The scales of lepidoids are readily distinguished by the hook-like process on their upper margins, this process fitting, like the hook of a roofing-tile, into a corresponding depression on the lower margin of the scale placed immediately above it.

Lepidolite (Gr. *lepis*, a scale, and *lithos*, stone).—A term applied to the fine pink-coloured varieties of *lithia-mica*, which differ chiefly from common or *potash-mica* in containing a considerable percentage of fluorine, and from 2 to 6 per cent of lithia.

Lépidomelane (Gr. *lepis*, scale, and *mêlar*, black).—A variety of uniaxial mica usually found in granitic veins, and occurring in small six-sided tables, or an aggregation of minute, opaque scales, united in granulo-laminar masses. So called from its usually raven-black colour.

Lepidophyllum (Gr. *lepis*, scale, and *phyllon*, leaf).—Small lanceolate leaves occurring abundantly in the shales of the Coal-measures, evidently of a woody rigid texture, having a midrib, and triangular at the base or point of attachment. They are regarded as the leaves of *Lepidodendron*; hence the name.

Lepidoptera (Gr.)—Literally "scale-wings;" an order of insects having two large wings covered with minute feathery-looking scales, as the Butterfly and Moth. The Lepidoptera, like the Diptera and Hemiptera, have sucking mouths. They have been found in Eocene and Miocene strata.—See **INSECTA**.

Lepidosteus (Gr. *lepis*, scale, and *osteon*, bone).—*Bony Pikes*; a genus of malacopterygian or soft-finned fishes, remarkable for the hard, bony scales with which they are covered. The body is, as it were, encased in these, and the two outer rays of the tail and fins are fringed with them. There are only three or four species known, and these inhabit the lakes and rivers of the warmer parts of America. They belong to the **GANOÏD** order of Agassiz, and, along with the genus *Polypterus* or Bony Pike of Northern Africa, are almost the only living representatives of the numerous ganoid or enamelled-scale fishes of the Secondary epoch.

Lepidostrobus (Gr. *lepis*, scale, and *strobilos*, a fir-cone).—Fossil cone-like organisms occurring abundantly throughout the Carboniferous formation. There is considerable variety in their configuration, the arrangement of their scales, and the form of their bases or points of attachment; and while there is no doubt of there being reproductive bodies analogous to the

cones of recent conifers and lycopods, there is still great difficulty in assigning the various forms to their proper places. In other words, while some may be the seed-cones of true Coniferae, others may belong to the Lepidodendron and Ulodendron, to Cycadaceae, or even to Calamites, with the stems of which they are so frequently associated.

Leptacanthus (Gr. *leptos*, slight, and *acantha*, a thorn or spine).—Literally “slender-spine;” a provisional genus of fossil fishes, so named by Agassiz, from their slender fin-spines, which are found in the Carboniferous Limestone, and in the Lias and Oolite. These ichthyodolites are the only parts known; and it is more than likely that the “slender-spines” of the Mountain Limestone and of the Oolite belong to very different species of cestraciant fishes.

Leptolepis (Gr. *leptos*, slender, and *lepis*, scale).—Literally “slight or slender scale;” a genus of small sauroid fishes occurring in the Lias and Oolitic formations.

Leptopleuron (Gr. *leptos*, slender, and *pleuron*, rib).—Literally “slender-rib;” the name originally proposed by Professor Owen for the small reptile found in the Upper Old Red of Elgin, now generally known by the generic term *teleosaurus*, which see.

Leptospondylus (Gr. *leptos*, slender, and *spondylos*, vertebra).—The generic term applied by Professor Owen to certain saurian vertebrae collected by Dr Orpen in the Drakenberg Mountains in Southern Africa.

Leucite (Gr. *leukos*, white).—Literally “white-spar;” a mineral allied to felspar, but by some taken as the type of a separate family. It is known also as *amphigene*, and is frequently associated with augite in lava, tufa, and other recent volcanic rocks. It consists, according to Klaproth, of 53.75 silica, 24.63 alumina, and 21.35 potash; and is remarkable as being the first mineral in which that chemist discovered that potash was a constituent of the mineral kingdom. From its occurring in trapezohedrons, similar to those of the common garnet, it is sometimes known as “white garnet” or “white garnet of Vesuvius.”

Leucopyrite (Gr. *leukos*, white, and *pyrites*).—Arsenical pyrites; arsenite of iron, consisting of 65.88 arsenic, 32.35 iron, and 1.77 sulphur. This ore is abundant in many localities, and is used for the production of white arsenic, and also of artificial orpiment.

Leucostine (Gr. *leukos*, white).—A Continental term for a white-coloured felspathic variety of lava.

Levant (Lat.).—Rising from below; the fourth of the fifteen series into which Professor Rogers subdivides the Palaeozoic strata of the Appalachian chain—the “Sunrise” of the North American palaeozoics; and the equivalents in part of our Lower Silurians.—See PALAEOZOIC FORMATIONS.

Level.—An English term for any flat alluvial plain of recent formation, in allusion to its usually level-like surface; e.g., “Lewes Levels” and “Beeding Levels” in Sussex, “Bedford Level” in Lincolnshire, &c.

Levigation (Lat. *levigo*, I polish, from *lavis*, smooth).—The process of pounding or rubbing down earths and minerals to a powder or paste. It is generally done with a *muller* on a metallic or stone table, and some fluid added to assist the operation. In this respect it differs from *trituration*, which may be called the dry method.

Levyne (after Levy the mineralogist).—One of the Zeolite family; a variety of *Chabasite*, occurring chiefly in amygdaloid and other trap-rocks, in white or yellowish hexagonal crystals.

LEY — LIE

Ley or Lye.—A technical term for a solution of any alkali, as soda or potash, in water.—See LIXIVIATION.

Lias, Liassic.—This term is said to be a corruption of *lyers*, or *layers*, and was originally applied to those thin-bedded limestones occurring at the base of the Oolitic system—the layers of limestone being conspicuously separated by thin partings of clay. It is now extended, in geological classification, to that group or series of strata which in England immediately overlies the Trias or Upper New Red Sandstone, and is in turn overlaid by the thick-bedded limestones of the Oolite proper. As developed in England, the Lias occupies a belt of variable breadth, extending from Lyme Regis in Dorset, northwards by Bath, Gloucester, Leicester, Newark, and Gainsborough to the Humber, and thence to the east coast of Yorkshire. Taken in Yorkshire, Northampton, and Somerset, the formation (according to Professor Phillips) exhibits in descending order the following members:—

1. *Upper lias clay or shale*, full of belemnites and other fossils, intercalated with or graduating into the sands of the Inferior Oolite, and in some cases containing nodules and bands of limestone.
2. *Marlstone*.—A suite of calcareous, sandy, and iron beds, very rich in fossils, and much analogous to the lowest beds of the Lower Oolite formation.
3. *Lower lias clay or shale*, full of fossil remains, interlaminated with bands and nodules of limestone, especially in the lower part, where a collection of these layers constitutes the “Lias rock.”
4. *Lias rock*.—A suite of laminated limestones, with partings of clay, blue, grey, and white, the former in particular containing gryphites and other shells; the latter usually devoid of organic remains. This rock is sometimes consolidated into a united mass, and sometimes divided into separate portions.

For further details and foreign equivalents, see OOLITE SYSTEM, and preliminary tabulations, “GEOLOGICAL SCHEME.”

Libethenite (Libethen in Hungary).—Phosphate of copper, occurring in many copper mines, in rhombic prisms or in radiated masses of an olive-green colour, resinous lustre, and brittle.

Licks.—An American term for swampy or boggy areas surrounding saline springs, the soil of which, being impregnated with salt or covered with saline incrustations, is *licked* by the wild cattle for the sake of the salt. Several of these seem to have been *licks* even during the Upper Tertiary period, for the surrounding soil contains the bones of the mastodon and other extinct mammals in such profusion (Big-bone Lick in Kentucky) as to warrant the conclusion that they were frequented by herds of those animals, just as they are by the herds of the present day.

Liebigite (after Baron Liebig, chemist).—Carbonate of uranium and lime, found in mammillary crusts and concretions in the mines of Saxony and Bohemia; of a beautiful apple-green colour, vitreous lustre, and transparent.

Lievrite.—A brownish-black mineral, occurring in long vertically-striated prismatic crystals along with quartz, magnetic iron ore, and copper pyrites in veins in the crystalline strata, and consisting, according to Vauquelin, of 30 silica, 57.5 iron peroxide, and 12.5 lime. It is named after the discoverer, Le Lievre; and is also known as *Ilvaite*, from Elba, and *Yenite*, in commemoration of the battle of Jena in 1806.

Ligneous (Lat. *lignum*, wood).—Woody; having the texture or quality of wood; as "ligneous fibre," "ligneous stems," &c.

Lignite (Lat. *lignum*, wood).—Wood-coal or fossil wood more or less mineralised and converted into coal. The lignites are usually of a dull dark-brown appearance; compact or laminated, and revealing the woody texture; and never present the crystalline structure or pitchy lustre of true coal. They burn with much smoke and dull flame; are poorer in carbon or coke than common coal; give much less heat; and leave in general a large residuum of earthy ashes. Lignitic beds occur in the New Red Sandstone and Oolite, but chiefly in the Upper Cretaceous and Tertiary formations, and present a great variety of aspects, some being almost as hard as true coal, and known as "stone-coal;" others being distinctly woody, and hence called "wood or board coal;" some again consisting of thin layers like compressed leaves, "paper-coal;" and others soft and earthy, and known as "peat-coal." Lignite thus passes, it may be said, through every gradation of texture, from the compacter peat-beds of the present day to the stone or mineral coal of the older formations. According to M. Frey, lignites may be distinguished from mere wood and peat, on the one hand, by their complete solubility in nitric acid and in hypochlorites; and from the true coals, on the other, which are insoluble in hypochlorites, and only slowly attacked by nitric acid. The well-known lignites or "*Brown Coals*" of Germany and the continent of Europe are chiefly Tertiary, and from the leaves, fruits, and stems of palms (fan-palm, date-palm, coconut-palm, &c.) which they contain, give evidence of the more genial climate of these latitudes during the Tertiary epoch.—See COAL, and TERTIARY FORMATION.

Lignitiferous (*lignite*, and *fero*, I yield).—Applied to strata or formations which contain subordinate beds of lignite or brown-coal.

Ligulate (Lat. *ligula*, a strap).—Strap-shaped; applied in natural history to objects, organs, and processes which are long and narrow like a strap.

Ligurite (from *Liguria*).—A variety of Sphepe; a mineral of an apple-green colour, consisting of silicate of alumina, lime, and magnesia; occurring in mica and talc-schists; and from its colour, hardness, and transparency, used as a gem.

Lily-Stone, Lily-Encrinite.—Familiar terms for the common Encrinite, from the fanciful resemblance of its stalk and clustered tentacles to the stem and flower of a lily.—See ENCRINITE and CRINOIDEA.

Limbelite.—A subordinate variety of olivine or chrysolite, occurring in small honey-coloured masses, and so named by Saussure, from the volcanic hill of Limbourg, where it occurs.

Lime.—Chemically, the protoxide of calcium, one of the metallic bases discovered by Davy in 1807. Mineralogically, one of the primitive earths, usually occurring in nature as a *limestone* or carbonate of lime, from which it is obtained by roasting at a red heat so as to expel the carbonic acid, and thus leave the lime or *quicklime* behind. If the limestone employed be very pure, as white chalk or Carrara marble, the residue will be the earth "*lime*"—white, very infusible, highly luminous when heated to full redness, and of a specific gravity about 2.3. It requires for solution about 500 parts of water, but diluted as this may appear, it acts powerfully as an alkali; has an acrid taste; and is thence regarded as one of the *alkaline earths*. If quicklime be sprinkled with water, it rapidly

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crumbles down to powder with great evolution of heat, and becomes *slaked lime* or *hydrate of lime*; and if this hydrate continue exposed to the air it gradually absorbs moisture and carbonic acid, and is reconverted into the *carbonate*. Combining readily with acids, the *salts of lime* occur abundantly in nature as *sulphate of lime* or gypsum; *fluates of lime* or fluor-spar; *phosphate of lime* or apatite; and so forth. The most abundant compound, however, is the *carbonate of lime* or ordinary limestone, which occurs in all states of purity, and in all stages of mineralisation—from soft earthy chalk to crystalline limestones or even transparent crystallised *calc-spars*. As an earth, lime is profusely disseminated in nature: as a rock, it enters largely into the composition of the earth's crust; it is less or more diffused in all its waters; it forms the principal ingredient (earth of bone) in the skeletons of the larger animals; and is secreted by many classes of the invertebrata to form their shells, crusts, shields, corals, and other means of protection. Economically it is also of vast importance, being used in the manufacture of mortars and cements, in tanning, bleaching, deodorising, and the like, and also in agriculture as a fertiliser, or promoter of vegetable decay.

Limestone.—The familiar as well as technical term for all rocks and rock-masses that are mainly composed of carbonate of lime, and are in their texture either earthy (chalk), compact (ordinary limestone), or crystalline (marble)—crystallised varieties of the carbonate being better known as *calc-spars*. Limestones occur in all formations; in all degrees of purity; and owe their origin—some to corals, encrinites, and shell-fish, others to accumulations of foraminiferal and kindred organisms, and others again to chemical precipitation from the waters in which they were deposited. The names by which their varieties are known to the geologist have reference to their origin, composition, texture, or other physical property, as “*encrinural limestone*,” “*shell limestone*,” “*magnesian limestone*,” “*saccharoid limestone*,” “*concretionary limestone*,” and the like. The quality or richness of a limestone is in general perceptible to the eye; and where this fails to satisfy, the application of sulphuric or muriatic acid (both of which dissolve limestone with violent effervescence), or the heating of a fragment before the blowpipe so as to convert it into quicklime, will without much trouble give the necessary indication.

Limnæine and Limnæidæ (Gr. *limnæ*, a marsh).—Terms applied to the River-snails; a sub-family of the HELIOMIZ or true Snails, and represented by the well-known marsh-shells *limnæa*, *physa*, and *planorbis*.

Limnæa (Gr. *limnæios*, marshy).—The “Pond-shell;” a well-known genus of fresh-water molluscs inhabiting lakes and ponds, and characterised by their pointed spire, elongated oval body, and delicate thin shell. About seventy species occur in Tertiary strata; the existing species are somewhat fewer in number.

Limonite.—The mineralogical term employed by Beudant and other modern writers for *Brown Iron Ore*, which embraces the brown hæmitites, ochry iron ore, ochre, bog-iron-ore, and other allied varieties of hydrated peroxide of iron.—See IRON.

Limpid (Lat.).—Clear, pure, transparent. Applied to fluids and crystals.

Limulus.—The Mollucca-crab, king-crab, or horseshoe-crab. A genus of crustaceans belonging to the family *Xiphosura* or sword-tails, and to the order *Pacilipoda*, or those having feet of different forms. In the limulus the dorsal plates are united in one piece or carapace; the abdominal shield

is more complex ; of the feet some are leaf-like and fitted for swimming, others are shear-shaped and perform the office of jaws, hence the term "jaw-feet." The tail is long, spear-shaped, and pointed. There are few species of existing limuli ; several *limuloid* crustaceans have been discovered in the Coal-measures ; but of these some may likely belong to the *Eurypteridae*, which are altogether fossil.

Line of Dip and Line of Bearing.—The direction in which strata dip or incline from the horizon is said to be the "line of dip ;" the direction of their strike or outcrop "the line of bearing." As the *dip* is always at right angles to the *strike*, if the one is known the other can readily be laid down ; thus, if the dip be to the N.W., the line of bearing will run from S.W. to N.E. and *vice versa*.

Lingula (Lat., a little tongue).—A genus of brachiopodous mollusca, so called from the tongue-like form of their valves. In the *Lingula* the two valves are nearly equal, of a horny texture, rather compressed, somewhat truncated in front, the hinge toothless, the beak of the valves rather pointed, and united to a tendinous pedicle by which the animal is attached to the sea-bottom. The existing *lingulæ* are found only in southern seas ; the fossil species, nearly forty in number, occur in all formations from the Lowest Silurian upwards, being found in British strata so recent as the Coralline Crag. The *Lingulidae* are thus one of the oldest families of mollusca—several species being highly characteristic of, and peculiar to, the lowest fossiliferous strata with which geology is yet acquainted.

Lingulate, Linguiform (Lat. *lingua*, the tongue).—Applied to leaves and other organisms which are shaped like the tongue ; tongue-shaped.

Linnæan.—Systems of classification, nomenclature, and methods introduced by Linnæus the great Swedish naturalist, who was born in 1707, and died in 1778, are so termed. The *Linnæan Systems* are often spoken of as *Artificial*, in contradistinction to the more *Natural* systems introduced by Jessieu in botany, and by Cuvier in zoology.

Liquefaction (Lat. *liquefacio*, I make liquid).—Literally, the passing of a substance from the solid to the liquid state, as the melting of ice ; but also often used as synonymous with *fusion*, *solution*, and *deliquescence*.

Liroconite (Gr. *leiros*, pale, and *konis*, dust ; in allusion to the paleness of its streak).—A hydrated arseniate of copper occurring in several copper mines in obtuse pyramidal crystals ; of a sky-blue or verdigris green ; vitreous lustre ; translucent ; and sectile.

Lithia (Gr. *lithos*, a stone).—An alkali or alkaline earth, discovered in 1818 by Arfwedson in a mineral called *petalite*, but since found in other minerals, and in very minute quantities in some mineral springs, as those of Carlsbad. As an earth it is caustic, alkaline, and sparingly soluble in water. It obtains its name from being found only in the mineral or stone kingdom.

Lithium.—The metallic base, of which *lithia* is the oxide, first obtained by Sir H. Davy from the hydrate of that earth by the action of the galvanic battery. Like *sodium*, &c., it is a white-coloured metal, but so exceeding oxidable that its properties cannot be fully examined.

Lithocarp (Gr. *lithos*, and *carpos*, fruit).—Any fossil fruit ; same as *Carpolite*, which is the term principally used.

Lithodomi, Lithodomous (Gr. *lithos*, and *domos*, a house).—Applied to certain mollusca, which, like the *pholas*, bore into solid rocks and form for themselves permanent lodgments—the perforation widening as the

animal grows larger and descends the deeper. It has been a long-discussed question among naturalists whether the perforation is made by mere mechanical rasping, or by the secretion of some chemical solvent; but the fact seems now well ascertained that the boring is performed solely by gradual and incessant friction.

Lithogenous (Gr. *lithos*, stone, and *ginomai*, I beget).—Applied to polyyps which secrete or build up stony structures, as the Coral-polype.

Lithographic Limestone, Lithographic Slate.—A peculiar magnesian limestone, slaty, compact, and fine-grained, usually obtained from the Lias and Oolite, and extensively employed in lithography. The finest stones are from Solenhofen and Pappenheim in northern Bavaria, but some of fair quality have been procured from the Lias of England. The most esteemed colour is a pale cream yellow, but excellent slabs of bluish-grey are not uncommon.

Lithoidal (Gr. *lithos*, and *eidos*, appearance).—Stone-like; having the texture or appearance of stone.

Lithology, Lithological (Gr. *lithos*, a stone, and *logos*, doctrine).—Applied to the physical characteristics or stratigraphical relations of rock-groups, in contradistinction to their palæontology or palæontological aspects. *Lithology* or *Petralogy* treats of the earth's crust as made up of mere inorganic rock-masses, and endeavours to discover their composition, origin, and the successive changes to which they may have been subjected; leaving to *Palæontology* all that relates to the fossils they contain, as manifestations of the life that has successively peopled the earth's surface. It has been proposed to distinguish between Lithology and Petralogy, by restricting the former to "the study of the internal structure, the mineralogical composition, the texture, and other characters of rocks, such as could be determined in the closet by the aid of hand specimens;" and the latter to "the study of rock-masses, their planes of division, their forms, their positions and mutual relations, and other characters that can only be studied in the field." Such a distinction, however, is rarely or never attended to—the two terms being employed synonymously.

Lithomarge (Gr. *lithos*, and *marga*, marl).—Literally "stone-marrow;" a term applied to several varieties of clay or fine-grained silicate of alumina, arising in some cases from the decomposition of felspathic rocks (e. g., Kaolin or China-clay) and in others from the deposition of aluminous springs. It is of various colours, striped and spotted; is massive, soft, and opaque; adheres strongly to the tongue; falls to powder in water, but does not form a paste, and has a greasy feel when containing a little magnesia, as is the case with some varieties. What is called *Hard lithomarge* is a more complex compound of a blue mottled colour, found in the Coal formation of Planitz in Saxony, and known as the *Terra Miraculosa Saxonica*, from its supposed medicinal virtues.

Lithophagi, Lithophagidae (Gr. *lithos*, and *phago*, I eat).—Applied to those shell-fish and other animals which bore holes, and form for themselves a lodgment, in limestone, coral, and other stony masses. Certain fish, like the *Scarus*, and many of the *Holothuræ*, are said to be *lithophagous*, as browsing and subsisting on the living coral.

Lithophyllum (Gr. *lithos*, and *phyllon*, leaf).—Volkman's term for the stigmara; and like *phytolithus*, which was Martin's designation for the same plant, often found in the older geologists.

Lithophyta, Lithophytes (Gr. *lithos*, and *phyton*, a shoot).—Literally

"stone-plants;" those polyyps which secrete a stony axis, as the Corals, in contradistinction to *Ceratophyta*, or those which secrete a horny axis, like the *Gorgonia* or Sea-fan.

Lithornis (Gr. *lithos*, stone, and *ornis*, bird).—Literally "petrified bird;" a generic term applied by Professor Owen to certain bird-remains from the London or Eocene clay of the Isle of Sheppey. From the close resemblance these bones to those of the vulture tribe, they are designated specifically as the *Lithornis vulturinus*.

Lithoxylon (Gr. *lithos*, stone, *xylon*, wood).—A mineralogical term for Wood-Opal, which see.

Littoral (Lat. *littus*, the sea-shore).—Belonging to, inhabiting, or taking place on the shore. Applied to operations and deposits which take place near the shore, in contradistinction to those of a deep-water or *pelagic* character.

Littoral Concrete.—"This term, which is of Bombay origin" (we quote Dr Buist of that town), "indicates distinctly and intelligibly a particular variety of rock, formed by the cementation of sea-sand or shells—the same as those now prevalent along our shores." The rains of certain regions are more surcharged with carbonic acid than others, and where this is the case "littoral concrete," often of great hardness and durability, is sure to be formed, by the action of these carbonated waters on the shells and other calcareous matter of the sands—the dissolved lime acting as the cement in artificial *Concretes*, which see.

Littoral Zone (Lat. *littus*, the shore).—That zone of marine life which lies between high and low water mark (varying in extent according to the rise and fall of the tide, and the shallowness of the shore), and which in British seas is characterised, as the bottom may be rocky, sandy, or muddy, by such mollusca as the periwinkle, limpet, mussel, cockle, razor-shell, &c., and by such plants as the bladder-wrack, dulse, and carageen.—See ZONE.

Lituus (Lat. *lituus*, a trumpet).—A genus of chambered shells peculiar to Silurian strata, and so named from their form—their whorls being partially coiled up at the smaller end, and the last chamber being produced into a straight trumpet-like tube. The *litu* is ranked under the *nautilida*; has the septa outwardly concave, and the siphuncle internal.

Lituolite (*lituola*, diminutive form of *lituus*).—A genus of minute foraminifera, so called from their spiral form and straight prolonged outer whorl; occur chiefly in the Chalk formation.

Liver Ore.—The *Hepatic cinnabar* of Phillips; a dark liver-coloured variety of sulphuret of mercury intimately intermixed with idrialite (Tosia in Spain), carbon, and earthy matter.

Liver Pyrites.—A familiar term for a liver-coloured concretionary variety of sulphuret of iron having an internal radiated texture.

Lixivation (Lat.)—The process of extracting the saline matter of bodies, more especially of ashes (as *kelp*), by means of steeping and washing in water. Such a solution is called a *ley*, *lye*, or *lixivium*, and the salts resulting from its evaporation *lixivial salts*.

Llandovery Rocks.—A term applied by Sir R. Murchison to certain sandstones and shales which seem to form a connecting link between the Lower and Upper Silurian series of South Wales. They are specially characterised by *Pentamerus*, *Atrypa*, and *Petraia*, and derive their name from the locality where their relations are most clearly developed.

Llanos (Span.)—In physical geography, the flat treeless plains that extend along the banks of the Orinoco. They are, for the most part, within the tropics, and during one half of the year are covered with grass, and for the rest desolate. They are of very recent alluvial growth, and are partly still in progress of formation.

Loadstone, Lodestone (Eng. *lead and stone*).—A familiar term for the *magnet*, which see; an ore of iron that possesses the peculiar property of attracting iron, and which, when freely suspended, invariably turns towards the North Pole or "Magnetic North."

Loam (Sax.)—A general, but not very definite term, applied to soils that are native admixtures of clay, sand, and vegetable mould—as being moderately cohesive, less tenacious than clay, and more so than sand. Agriculturists speak of *light* and *heavy* loams according to the proportion of clay they contain; and also of *sandy, calcareous, and gravelly* loams, just as sand, lime, or gravel happen to be characteristic ingredients.

Lode.—A Cornish term for any regular vein or course, whether metaliferous or merely composed of veinstone. In the former instances they are said to be *alive*, in the latter they are termed *dead* lodes.

Loess or Lehm.—A German term for an ancient alluvial deposit of the Rhine replete with fresh-water shells of existing species. According to Lyell, "it is a finely-comminuted sand or pulverulent loam of a yellowish grey colour, consisting chiefly of argillaceous matter, combined with a sixth part of carbonate of lime, and a sixth of quartzose and micaceous sand"—thus closely agreeing in composition, as ascertained by Bischoff, with the mud of the Nile. Interstratified with it are volcanic ashes thrown out by the now extinct volcanoes of the Eifel and adjacent districts, and the Rhine has since eaten out a passage, frequently leaving exposed cliffs of considerable altitude. In general it ranges from thirty to fifty feet in thickness; is found as much as 1500 feet above the present sea-level; and where it terminates near Switzerland, it is said to repose on rolled flints and pebbles of the Older Drift period.

Loganite (after Sir W. E. Logan, director of the Canadian Geological Survey).—A hydrated silicate of magnesia and lime; a variety of Pyroclerite occurring in the serpentinous rocks of Canada in short, thick, oblique-rhombic crystals, of a clove-brown colour, sub-transparent, and of a weak sub-resinous lustre.

Logan-Stones.—Properly "Logging-stones," and perhaps better known as "Rocking-stones;" weather-worn blocks so finely balanced on their pivot-like bases that a very ordinary force suffices to make them "log," or "rock" from side to side. The following description, by Dr Paria, of the celebrated Logan-stone near the Land's End, conveys an intelligible idea of the nature and origin of these curiously-poised blocks: "The foundation of this part of the coast of Cornwall is a stupendous group of granite rocks, which rise in pyramidal clusters to a great altitude and overhang the sea. The celebrated Logan-stone is an immense block, weighing above sixty tons. The surface in contact with the under rock is of very small extent, and the whole mass is so nicely balanced, that, notwithstanding its magnitude, the strength of a single man applied to its under edge is sufficient to make it oscillate. It is the nature of granite to disintegrate into rhomboidal and tabular masses, which, by the further operation of air and moisture, gradually lose their solid angles and approach the spheroidal form. The fact of the upper part of the cliff being more exposed to the

atmospheric agency than the parts beneath, will sufficiently explain why these rounded masses so frequently rest on blocks which will preserve the tabular form; and since such spheroidal blocks must obviously rest in that position in which their lesser axes are perpendicular to the horizon, it is equally evident that, whenever an adequate force is applied, they must vibrate on their point of support."

Lonchópteris (Gr. *lonche*, a spear, and *pteris*, fern).—Literally "spear-leaf;" a fossil fern-like frond occurring in the Coal-measures, Lias, Oolite, and Wealden, and so called from its resemblance to the recent *Lonchitis*. The leaves are many times pinnate; leaflets adherent to each other at their base, traversed by a midrib, and furnished with reticulated veins.

London Clay.—One of the members of the Lower Tertiary or Eocene beds of the London basin, and so called from its being largely developed under, and in the vicinity of, the metropolis. It consists of a tenacious bluish-black clay, varying from 300 to 600 feet in thickness, enclosing numerous bands of septaria, and (along with the accompanying strata) abounding in marine shells of extinct species—crabs, lobsters, and other crustaceans—teeth of sharks and many other genera of fishes—bones of crocodiles, turtles, serpents, and birds—leaves, fruits, stems of plants, and rolled trunks of trees perforated by boring mollusca—all indicating a warm and genial climate.—See TERTIARY SYSTEM.

Longitude (Lat. *longitudo*, length).—The distance of a place measured in degrees, minutes, and seconds, east or west of any fixed meridian. In Britain, the fixed meridian is that of the Observatory of Greenwich; and in other countries it is usually that of their capitals. If the place be east of the fixed meridian, it is said to be in E. Long., and if west, in W. Long.—See LATITUDE.

Longmynd Rocks.—In geological classification the terms "Longmynd Rocks" or "Bottom Rocks" are meant to embrace all those unfossiliferous, or but sparingly fossiliferous, conglomerates, grits, schists, and slates, which lie at the base of the Silurian system. They are typically developed in the Longmynd Hills, Shropshire (whence the name); are regarded by the Government Geological Surveyors as constituting the "Cambrian System;" but are still retained by Professor Sedgwick as the mere basis or under-group of his original "Cambrian Rocks."

Lophiodon (Gr. *lophion*, a small crest or ridge, and *odous*, tooth).—An extinct tapir-like pachyderm of the Tertiary epoch; so called from certain points or eminences on its teeth. Several species have been catalogued, but as yet very little is known as to its true relationship.

Lorate (Lat. *lorum*, a thong).—Applied in botany and zoology to organs or members having the shape of a thong or strap.

Loricated (Lat. *lorica*, a coat of mail).—Covered or clad with horny or bony plates or scutes, like the alligator and crocodile.

Lower-Level Gravels.—The term now generally applied to all the sands and gravels that occur in the lower terraces of valleys, in contradistinction to the "high-level gravels," which see. While the high-level deposits are destitute or nearly so of organic remains, the lower are generally replete with the remains of extinct minerals, such as the mammoth, Irish elk, and reindeer, associated in many instances with flint implements and other evidences of human contemporaneity.

Lóxoclase (Gr. *loxos*, oblique, and *klasis*, cleavage).—A variety of ortho-

class (which see), containing a large proportion of soda (from 7 to 9 per cent) ; of a yellowish-grey colour, and semi-translucent.

Lóxodon (Gr. *loxos*, oblique, and *odous*, tooth).—One of the sub-genera into which Dr Falconer divides the Elephants. The term has reference to the rhomb-shaped discs of the worn molars ; and comprises both extinct and living species.

Loxomma (Gr. *loxos*, oblique, and *omma*, the eye).—A genus of labyrinthodon reptiles founded by Professor Huxley on a portion of a skull in the University Museum, Edinburgh, from the Midlothian Coalfield ; and so named from the very oblique disposition of the long axes of the eye-orbits, which in addition to this feature are also larger and more backward in position than in any known genera of Labyrinthodonta.

Loxonéma (Gr. *loxos*, and *nema*, thread).—A fossil genus of pyramidal-shaped shells, belonging to the gasteropodous family *Pyramidellida*, and so named in allusion to the thread-like striae which mark the surface of many species. The shell is elongated and many-whorled ; aperture simple, attenuated above, effused below, with a sigmoidal edge to the outer lip. The species are numerous, and occur from the Silurian to the Trias inclusive.

Lucullite.—A variety of black marble, so called from its being first brought by Lucullus to Rome, from an island in the Nile.

Ludlow Rocks.—According to Murchison, the uppermost group of the Silurian system ; and so termed from being characteristically developed near the town and castle of Ludlow, in Shropshire. They consist, in that district, of thin flaggy sandstones (tilestones) ; of shales with calcareous bands ; and of limestones (Aymestry limestone)—all highly fossiliferous.—See SILURIAN SYSTEM.

Ludus Helmontii (after Von Helmont).—An old mineralogical term for a variety of *Septarium* (which see) in which the sparry veins were frequent and anastomosing.

Lumachello, Lumachelli (Ital.).—A variety of marble full of fossil shells, exhibiting beautiful iridescent colours ; sometimes deep red or orange, when it is known by the name of *Fire-marble*.

Lumbar (Lat. *lumbus*, the loins).—Pertaining to the loins, as “lumbar muscles,” “lumbar vertebræ,” &c.

Lustre (in Rocks and Minerals).—Lustre, like colour, fracture, cleavage, &c., is often taken as a characteristic of minerals and rock-compounds, but cannot be well described without the inspection of actual specimens. It refers to the intensity and quality of the light reflected from their newly-fractured surfaces, and in this respect differs from colour, which is an inherent property. Several degrees of intensity have been named by mineralogists ; as *Splendent*, when a mineral reflects the light so as to be visible at a distance, and well-defined images are formed on its surface, as in galena and rock-crystal ; *Shining*, when it is weaker and cloudy, and images only are formed, as in heavy-spar ; *Glistening*, when the light is not observable at greater distance than an arm's length ; *Glimmering*, when only a number of small shining points are observable near the eye, as in crystalline limestone ; and *Dull*, when no lustre can be discerned, as in chalk. The kind or quality of lustre is also defined by such terms as *Metallic*, seen in pyrites and glance-coal ; *Adamantine*, as seen in the diamond ; *Vitreous*, as in glass or rock-crystal ; *Resinous*, as in pitchstone and garnet ; *Pearly*, as in some gypsums, talc, and mica ; and *Silky*, as

seen on the polished surfaces of amianthus. These degrees and qualities often shade insensibly into one another, and though exceedingly useful in description, often require a very practised eye to distinguish between them.

Lusus Naturæ.—Literally "sport or freak of nature." A frequent term of the older naturalists for any appearance or production that seemed to lie out of the ordinary course of nature's operations. Thus fossil organisms were regarded as "*lusus naturæ*" by those who believed that the earth's crust was the result of one simultaneous act of creation, and not the result of long-continued operations, such as those that are now taking place around us.

Lycopodiaceæ.—A natural order of Cryptogamic or flowerless plants, of which the *lycopodium* or club-moss has been taken as the type. In their tissues and mode of fructification the club-mosses resemble ferns; in their foliage they approach the coniferæ; and in their general aspect they are like the mosses; hence they are said to stand intermediate between the Conifers and Ferns on the one hand, and the Ferns and Mosses on the other. Their stems divide by forking repeatedly, and are closely covered with simple leaves, which are arranged in two rows, having their edges vertical with respect to the axis of growth, and not horizontal. These leaves are placed alternately, and are furnished with smaller lateral leaflets of the nature of stipules. The scars left by the leaves arrange themselves spirally round the stem, and in this arrangement, as well as in their rhomboidal or lanceolate shape, greatly resemble the leaf-scars of the Coniferæ.—See LEPIDODENDRA and CONIFERÆ.

Lycopodites.—Fossil plants apparently allied to the Lycopodiums or club-mosses of the present day. They occur in the Tertiary, Secondary, and Upper Palæozoic strata—those of the Coal-measures being represented by gigantic arborescent species.

Lydian Stone.—Flinty slate; a mixed siliceous rock, usually of a greyish-black colour, splintery or conchoidal fracture, and keen cutting grain. It is common in many countries, and has long been used as a touchstone for gold, whose purity is shown by the colour of the streak which it leaves on the smoothened surface of the touch-slate. It often passes insensibly into *jasper*, *hornstone*, and other allied siliceous rocks; and hence is sometimes known as "black jasper."—See BASANITE.

Lye or Ley.—A solution of an alkaline substance, as potash or soda, in water.—See LIXIVIAM.

Lyxx Sapphire.—A lapidary's term for dark-grey or greenish-blue varieties of sapphire; also for varieties of Iolite, having the same colour. The paler shades are known as *Saphire d'eau*, or *Water Sapphire*.—See IOLITE.

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Macacus.—The Bonnet-apes, or Ape-baboons. A genus of Old World monkeys, belonging to the group *Cercopithecina* and family *Simiidae*; characterised by having a fifth tubercle on their last molars; ischial callosities and cheek-pouches; comparatively short and thick limbs; a projecting muzzle and prominent eyebrows; and generally very short tails. According to Owen, remains of a genuine ape have been found in the Pliocene deposits of Essex, and still earlier in the Eocenes of Suffolk; hence the species *Macacus eocenus*.

Maccagnone.—The Grotta di Maccagnone; an important ossiferous cavern situated in the Hippurite limestone, westward of the Bay of Carini (between Palermo and Trapani), and containing the usual cave-remains of elephants, hippopotami, rhinoceroses, bears, hyænas, horses, deer, &c., in the main mass of stalagmite; and in the upper layers, bits of carbon, and abundance of flint and agate knives of human manufacture.

Maceration (Lat. *macerare*, to make soft by steeping).—The steeping of vegetable or animal substances in a cold liquid till their tissue or fibres become softened, and part more readily with any peculiar principle (oily, aromatic, &c.) which they may contain. *Infusion* is performed by pouring the hot liquid over them; *decoction*, by boiling them in it for a longer or shorter period.

Machairodus (Gr. *machaira*, a sabre, and *odus*, tooth).—A genus of carnivorous mammals found in the Miocene, Pliocene, and Pleistocene Tertiaries and bone-caves of Europe; and so called from the trenchant, sharp-pointed, sabre shape of its upper canines. There were several species, some as large as the grizzly bear and lion, others about the size of the leopard and under. Professor Owen finds its nearest affinities in the lion; hence his synonyme of *Felis spelæa*.

Macigno or Macigna Piétra.—An Italian term for a hard siliceous sandstone, apparently of Cretaceous age, imbedding calcareous grains, &c., and occurring interstratified with the fine saccharoid marbles of Carrara.

Macled (Lat. *macula*, a spot).—Literally "spotted;" applied to surfaces that are covered with spots of a hue deeper than, or different from, the main ground of the substance. Some sandstones, for example, are macled with reddish spots of iron peroxide; some clay-slates macled with crystals of iron-pyrites.

Macles.—Applied in mineralogy to "twin-crystals," which are united by simple contact of their faces by interpenetration, or by incorporation. These twin forms are often repeated so as to form groups or compound macles. *Chistolite* (which see), from the twin form of its crystals, is not unfrequently termed "*Macle*."

Maclurea (after Dr Maclure).—A genus of flatly-spiral operculated shells, often of large dimensions, and especially characteristic of Lower Silurian strata. The species differ in the convexity and number of the whorls. Supposed by some to be gasteropod; but the character of the spiral operculum or small upper valve inclines Mr Woodward to regard it as an ancient form of the *RUDISTA* or *HIPPURITE* group, which see.

Maciáreite (after Dr Maclure).—One of the gems, known also as *Brucite*, *Hemiprismatic Chrysolite*, and *Chondrodite*, which see.

Macrauchenia (Gr. *makros*, long, and *auchen*, the neck).—Literally "long-neck;" an extinct Tertiary mammal of South America, having the nearest affinities to the existing *Llama* of that continent, but of more gigantic dimensions, and standing intermediate, as it were, between the camels and llamas.

Macro- (Gr. *makros*, large).—A frequent prefix in natural science, signifying *large*; as *macrocephalous*, large-headed; *macrodactylous*, long-toed; *macropodal*, large-footed; *macrourous*, long-tailed, &c.

Macropoma (Gr. *makros*, large, and *poma*, operculum).—A genus of sauroid fishes peculiar to the Chalk and Wealden, and so named from its large opercula—the head being equal to one-fourth of the entire length of the body, which in full-grown specimens was about two feet. In the *macropoma* the scales were large, and the anterior dorsal fin armed with spines. The coprolites, which often contain scales of other fishes, show that it was carnivorous in its habits.

Macropus (Gr. *makros*, large, and *pous*, foot).—The kangaroo, in allusion to the great length of its hind feet; a well-known marsupial, confined exclusively to the Australian continent, and in the ossiferous caverns of which remains of much larger species than any now existing occur in considerable abundance.

Macrotherium (Gr.).—Literally "large beast;" a genus of edentate mammals from the Miocene Tertiaries of Europe, having affinities to the African pangolin or ant-eater, but six or eight times its size.

Macroura, **Macrúra** (Gr. *makros*, long, and *oura*, tail).—A family of decapod crustaceans, characterised by the large size of the tail, as in the common lobster; and distinguished from the *brachyoura* or short-tailed, like the crab. Both families are found fossil in Secondary and Tertiary strata; but in the Palæozoic only the *macroura* are as yet known.

Mactra (Gr., a kneading-trough).—A well-known littoral bivalve inhabiting sandy and muddy shores ranging from ten to twelve fathoms in depth, and so named from a fanciful allusion to its shape. There are several species, recent and fossil; the latter occurring only in the Upper Tertiaries.

Madrepore (Fr.).—Literally "spotted pore;" an extensive genus of coral-building polypes, whose stony secretion is characterised by its spreading or branching form, and by the numerous star-shaped cavities that dot its surface, each cell being the abode of a single but united polype. The term is more frequently applied to the stony-coral than to the polype—madrepores being amongst the most abundant corals in the reefs of existing seas.

Madreporeite.—Fossil madrepore; also a variety of limestone having a small prismatic or columnar structure which looks like the pore arrangement of coral, but which in reality is a species of crystallisation.

Maastricht Beds.—"On the banks of the Meuse, at Maastricht," says Lyell, "reposing on ordinary white chalk with flints, we find an upper calcareous formation about 100 feet thick, the fossils of which are on the whole very peculiar, and all distinct from Tertiary species. The upper part of the rock, about 20 feet thick, abounds in corals and bryozoa; these beds are succeeded by a soft yellowish limestone 50 feet thick; and the stone below is white, and encloses occasional nodules of grey chert and

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chalcedony." These so-called "Maastricht beds," from containing *belemnites*, *hamites*, *baculites*, &c., are regarded as the uppermost member of the Chalk formation in Europe; they are wanting in England; and in geological classification are erected into a group which embraces the *calcaire pisolithique* near Paris, the *Maastricht beds* proper, and the *coralline limestone of Faosé* in Denmark.—See CRETACEOUS FORMATION.

Magnes.—An ancient name for the Lodestone, after Magnesia, a province in Lydia, where it was said to have been first formed.

Magnésia.—One of the alkaline earths, a light whitish substance, occurring abundantly in nature in various states of combination. It is found native in veins of serpentine, forming a *hydrate of magnesia* (69 magnesia and 31 water), but soon passes into the carbonate on exposure to the air. Magnesia enters largely into the composition of many primary rocks (steatite, serpentine, talc, &c.), giving to them a soft soapy feel: as a *carbonate*, in combination with carbonate of lime, it constitutes magnesian limestone, found extensively in the Secondary and Palæozoic strata; as a *sulphate*, it is common in many waters, as those of Epsom, Seidlitz, &c.; as a *muriate*, it is found in the waters of the ocean; and other combinations, as *borates*, *silicates*, &c., are by no means rare. The origin of the word is conjectural; some deriving it from the city *Magnesia*; others from an old term applied to such substances as had the power of attracting some principle from air or water.

Magnesia Alum.—A substance occurring in white fibrous masses and efflorescences in the salinas of South America, and consisting of 13.4 sulphate of magnesia, 38.3 sulphate of alumina, and 47 water, with traces of lime and iron.

Magnésian Limestone.—Any limestone containing upwards of 20 per cent of magnesia may be so called. The term is often used by English geologists as synonymous with Permian or Lower New Red Sandstone—magnesian limestone being largely developed in that formation in the North of England. As magnesian limestones occur, however, in other formations, the term should be regarded as descriptive of a rock merely, and not as the synonyme of any stratified series. Magnesian limestone, in its compacter states, forms a most durable building-stone; and on assuming the semi-crystalline and crystalline state passes into *Dolomite*.—See PERMIAN SYSTEM.

Mágnésite.—A compact amorphous carbonate of magnesia, usually found in serpentine rocks, white or greyish-white, somewhat meagre to the touch, adheres to the tongue, and consists in its purest state of about 51 magnesia and 49 carbonic acid.

Magnésium.—The metallic base of magnesia, a silvery-looking metal, which fuses at a red heat, and on burning passes into magnesia or oxide of magnesium (61.4 magnesium, 38.6 oxygen).

Magnet (said to be from *Magnesia*, where the loadstone, or native magnetic iron, was found in abundance).—Magnets are defined as "substances which attract certain metals; which display towards one another a force partly attractive and partly repulsive; and which exhibit a tendency to arrange their mass in certain directions, or according to a law of *polarity*." They are spoken of as *natural* and *artificial*—the former being the "loadstone" or native magnetic iron, and the latter certain arrangements of steel bars to which the magnetic property has been communicated by induction, and known as "bar magnets," "horse-shoe magnets,"

"compound magnets," &c. When the artificial magnet is left to move freely on a pivot or otherwise, as in the mariner's compass, it is spoken of as a *needle*, and invariably assumes a definite direction as regards the earth, this direction being towards the *magnetic north* or *magnetic pole*.

Magnetic Fluid.—The hypothetical natural agent to which the various phenomena of magnetism are usually referred, and spoken of as a *fluid* from its continuous motion or flow in certain fixed directions.

Magnetic Iron Pyrites.—Known also as *rhombohedral iron pyrites*, and *pyrrhotine*, a native sulphuret of iron occurring in tabular or short prismatic crystals of a bronze-yellow or copper-red colour, and more or less magnetic. It is found chiefly in veins with other ores in the igneous and older crystalline rocks.

Magnetic Meridian, Magnetic North.—The mean direction which a freely suspended horizontal needle assumes when left to itself is termed the "magnetic meridian," in contradistinction to the true meridional north and south as indicated by the sun's shadow at noon. The magnetic meridians coincide with the geographical meridians in some places, and in these the magnet points to the true north and south—that is, to the poles of the earth's rotation. But if it be carried successively to different longitudes, it will deviate sometimes to the east and sometimes to the west of the true north. This deviation appears to be secular; in other words, to oscillate within certain limits in a given time. Thus in 1660 the needle pointed due north in London; after 1662 it began to diverge to the westward, till in 1815 it pointed $24^{\circ} 15'$ west of north. Since 1815 it has been gradually returning from this extreme divergence, till now, in the British Islands, the geologist has to allow from 22° to 23° for his compass bearings. The dip and strike of strata, lines of fault, veins and cleavage, axis of elevation, and the like, are almost invariably laid down in reference to the true meridian.

Magnetic Needles.—The magnetised bars of steel known as "magnetic needles" are of two kinds—the *declination-needle* and the *dipping-needle*. The former, as seen on the common mariner's compass, revolves in a horizontal direction, and points to the magnetic north; the latter moves in a plane perpendicular to the horizon, and dips more and more as we approach the magnetic poles, where its position becomes vertical.

Magnetic Poles.—In the northern hemisphere the north end of the dipping-needle leads or dips to the north; in the southern hemisphere the south end dips to the south; but between the two there is a line encircling the whole earth where the needle remains horizontal. This line is termed the *magnetic equator*, or "line of no dip." As we proceed northwards or southwards of this line the needle dips more and more, till at last it becomes vertical or perpendicular to the horizon in two points, or rather linear spaces, which are known as the north and south *magnetic poles*. These poles differ from the poles of the earth's rotation—the north, as determined by Sir J. Ross, being in 70° N. lat. and 97° W. long.; and the south in $75^{\circ} 5'$ S. lat. and $154^{\circ} 8'$ E. long.

Magnetism.—Literally, the attractive and repulsive power of the natural magnet or loadstone; generally, that peculiar property possessed by many mineral bodies and by the whole mass of the earth itself, by which, under certain circumstances, they mutually attract and repel one another, according to determinate laws. "Very delicate experiments have shown that all bodies are more or less susceptible of magnetism. Many of the gems give signs of it; titanium and nickel always possess the properties

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of attraction and repulsion; but the magnetic agency is most powerfully developed in iron, and in that particular ore of iron called *loadstone* or *magnetite*. A metal is often susceptible of magnetism if it contain only the 130,000th part of its weight of iron—a quantity too small to be detected by any chemical test. One of the most distinguishing tests of magnetism is *polarity*, or the property a magnet possesses, when freely suspended, of spontaneously pointing nearly north and south, and always returning to that position after being disturbed. *Induction* is the power which a magnet possesses of exciting temporary or permanent magnetism in such bodies in its vicinity as are capable of receiving it. By this property the mere approach of a magnet renders iron or steel magnetic—the more powerfully, the less the distance. Iron acquires magnetism more readily than steel, yet it loses it as quickly on the removal of the magnet, whereas the steel is impressed with a lasting polarity. There can hardly be a doubt but that all the phenomena of magnetism, like those of electricity, may be explained on the hypothesis of one ethereal fluid, which is condensed or redundant in the positive pole, and deficient in the negative.”—(*Mrs Somerville, as abridged by Dr Humble.*) While there can be little doubt of the identity of magnetism with electricity (since magnets can be made to exhibit all the phenomena of electrical machines), still it must be regarded in great measure as one of those unseen existences which are only known by their effects. Terrestrial magnetism, which pervades the whole earth, and with which geologists have most to do, is a subject of extreme complicity; and though often called in by the theorist to aid him in his views respecting crystallisation, cleavage, jointing, and other phenomena, it must be fairly admitted that science is not yet in a position to point out either the extent of its results or its precise mode of working.

Magnetite.—Known also as *magnetic iron*, *oxidulated iron*, and *octahedral iron-ore*; consists of about 69 iron peroxide, with 31 iron protoxide. It occurs largely in the igneous and metamorphic rocks, either in distinct octahedral crystals, disseminated through the mass, or more frequently in compact beds, forming, as in Norway, Sweden, and Russia, a most important ore of iron. It rarely appears in veins; and the largest known masses are situated in the northern parts of the globe—Scandinavia, Russia, Siberia, and North America.

Mailed (Fr. *maille*, a coat of armour).—Having the body protected by a coat or covering of scales, bony plates, or other hard substance; *e. g.*, the Armadillo, Glyptodon, &c.

Malachite.—The green carbonate of copper, consisting of 71.8 copper protoxide, 20 carbonic acid, and 8.2 water, and deriving its name, it is said, from the Greek *malache*, the marsh-mallow, in allusion to its colour. As an ore of copper, malachite rarely occurs crystallised, but is either foliated, fibrous, compact, or earthy; and usually in reniform, concretionary, or stalactitiform masses. The copper mines of Siberia and the Ural furnish the finest specimens, which, when cut and polished, are highly prized for ornamental purposes. Malachite seems, in many instances, to be a recent production, caused by the action of the water and carbonic acid of the atmosphere on other copper ores; and is in fact a *copper-stalagmite*.

Malacolite (Gr. *malakos*, soft, and *lithos*).—Known also as *Sahlite*; a variety of augite of various shades of green, and of a vitreous or sub-pearly lustre.

Malacology (Gr. *malakos*, soft, and *logos*, discourse).—The science which

treats of the mollusca—a term occasionally substituted for that of *Conchology*, as referring more immediately to the structure and functions of the animals, many of which are shell-less; while *Conchology* relates, on the other hand, more especially to the shell or mere external covering (*concha*, a shell) of those orders so provided.

Malacopterygii (Gr. *malakos*, soft, and *pterygion*, winglet or fin).—One of Cuvier's primary divisions of Osseous Fishes, in which the fins are all soft or jointed. It is farther subdivided, according to the position or absence of the ventral fin, into—1. *M. abdominales*, in which the ventral fins are attached to the abdomen behind the pectorals (chiefly fresh-water species); 2. *M. sub-brachiati*, in which the ventral fins are brought forward under the pectorals (chiefly marine fishes); and, 3. *M. apoda*, in which the ventral fins are always wanting, and not unfrequently the pectoral also.

Malleable, Malleability (Lat. *malleus*, a hammer).—A property of many metals, by which they are capable of being beaten out into thin plates or leaves by the hammer. Gold, silver, iron, copper, &c., are *malleable*.

Mallotus (Gr. *mallos*, a lock of wool).—The capelan, a small, soft-finned fish (whence the name) rather larger than a sprat, which inhabits the banks of Newfoundland, and other parts of the coasts of northern seas. Fossil specimens occur in nodules of indurated clay-marl on the coast of Greenland; but these are of very recent date, and, it may be said, still in the process of formation.

Malm-Rock.—A local term for a calcareous sandstone which forms portions of the *Upper Greensand* in the counties of Surrey and Sussex. It is known also as "fire-stone."

Maltha.—A term occasionally applied to sluggy mineral pitch, as distinct from fluid *petroleum* on the one hand, and from solid *asphalt* on the other.

Mammaliferous.—A term applied to strata containing mammalian remains, as the "Mammaliferous Crag" of Norfolk, the "Mammaliferous Gravels" of Siberia, &c.

Mammals, Mammalia (Lat. *mamma*, a teat or pap).—The general term for all animals that give suck to their young. They constitute the first or highest class of VERTEBRATA, and are usually divided into *Placentalia* and *Implacentalia*—the former being those that are nourished previous to birth by a uterine network of blood-vessels called the *placenta*, and do not come into the world until they are provided with all their organs; the latter, those that are non-placental, or have no attachment to the uterus, and are brought forth in an imperfect state—the young being received into an external pouch (*marsupium*), and there nourished till their organs are matured. The non-placentals are comparatively few in number, are chiefly confined to the Australasian continent, and are regarded as lower in the scale of being than the placentals. Remains of Marsupial Mammals have been found in the Triassic and Oolitic rocks; the higher orders not till the Chalk and Tertiaries.—See tabulations, "ANIMAL SCHEME."

Mammifers (Lat. *mamma*, a breast, and *fero*, I bear).—Literally "breast-bearing animals," or those which give suck to their young. Same as *mammals* and *mammalia*.

Mammillary, Mammillated (Lat. *mamilla*, little pap).—Applied to surfaces covered with pap-like excrescences or concretions, as some magnesian limestones studded with rounded projections.—See BOTRYOIDAL.

Mammoth (Tartar).—The great fossil elephant of Siberia; the *Elephas primigenius* of scientific authors. Remains of the mammoth are found

abundantly in many of the Post-pliocene or Upper Tertiary deposits of northern Asia and Europe—the range of the animal being apparently between the 40th and 70th parallels of latitude, and its metropolis, according to Professor Owen, “the northern extreme of the temperate zone.” The Mammoth differs from existing elephants chiefly in its greater size, its dentition, which was fitted for milling coarser and less succulent vegetation, its immense recurved tusks, and its dense covering of shaggy hair, which fitted it for a cold and rigorous climate. Whole drifts of its tusks and bones are found in the northern ocean, and in the tundras and river-gravels of Siberia (*Von Wrangell*); and scattered tusks and bones are frequent in all the ancient alluvia of northern Europe and the British Islands. —Owen’s ‘Fossil Mammals.’

Manatide (Lat. *manatus*, the sea-cow).—The *Sirenia* of some systematists; a family of aquatic herbivorous mammals, including the manatee, dugong, &c. Remains apparently of this family are occasionally found in Pleistocene and ancient estuary-deposits.

Manganese (Lat.).—A hard, brittle, greyish-white metal (somewhat resembling iron), discovered by Gahn in the black oxide of manganese of commerce. Its specific gravity is about 8; it is fused with great difficulty, but is readily oxidised. In an oxidised state manganese is abundant in the mineral kingdom, and traces of it have been found in the ashes of plants, and in mineral waters. The ores of manganese are erected by some mineralogists into a separate family, including such genera as *manganite*, or the grey oxide; *wad*, or the earthy protoxide; *cupreus manganese*; *pyrolusite*, or the dark peroxide; *psilomelane*, a compound of the peroxide and baryta; *Hausmannite*, *Braunite*, &c.—all described under their separate heads. The ores of manganese are largely used in the arts: as in glass-making; in pottery painting and glazing; in painting glass and enamel; in the production of oxygen, chlorine, and chloride of lime; and occasionally for an admixture for improving the make of iron and steel.

Manganite.—Grey oxide of manganese, consisting, according to Turner, of 62.72 manganese, 27.18 oxygen, and 10.10 water. It occurs in veins in gneiss and other crystalline rocks, either in groups of prismatic crystals, or in radiating and columnar aggregates; and is the purest and most beautifully crystallised of the ores of manganese.

Mantellia.—Considering the fossil oycadeoidea of the Isle of Portland as a peculiar type, M. Brongniart has referred them to a new genus under the name of *Mantellia*, in honour of the late Dr Mantell. These stems are of a sub-cylindrical shape, covered with rhomboidal leaf-scars, which are widest transversely, and are from one to two feet in height, and from one to three in circumference. They are termed “Crows’ nests” by the quarrymen, who regard them as the nests of the former inhabitants of the now petrified forests of the Oolite.

Marble (Lat. *marmor*).—Any rock susceptible of a fine polish is termed “marble” by the stone-cutters; hence we hear of *Portsoy marble*, which is a true serpentine; of *Silician marble*, which is often a brecciated lava, and so forth. The term, however, should be, and is restricted by geologists to limestones capable of receiving a polish, and frequently exhibiting a variety of colours. We have thus *uni-coloured* marbles, such as pure blacks or whites; and *parti-coloured* varieties, deriving their shades from accidental minerals, from metallic oxides giving them a veined and clouded appearance, or from shells, encrinurites, corals, and other organisms which

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impart a variety of "figure" as well as of hue. Every country has its own peculiar marbles, and almost every age has had its own whims and fancies for certain varieties. The following are a few of the most esteemed varieties, ancient and modern :—*Carrara*, pure white, crystalline, and semi-transparent; highly esteemed for statuary purposes. *Parian*, of a waxy cream-colour, also crystalline, and employed in statuary. *Giallo-antico*, yellow and mixed with a small proportion of hydrate of iron; used for ornamental purposes. *Rosso-antico*, a deep blood-red, less or more veined. *Mandelato*, a light red, veined and clouded. *Verde-antique*, a cloudy green mixed with serpentine. *Cipoline*, a mixture of talcose schist with white saccharoidal marble. *Lumachello* or *fire-marble*, a dark brown variety, having brilliant chatoyant reflections, which it owes to the nacreous matter of enclosed shells. *Black marbles*, like those of Derbyshire and Kilkenny, deriving their dark colours from bitumen. *Encrinal marbles*, like those of Derbyshire, and other Carboniferous districts, deriving their "figure" from the stems and joints of encrinites. *Shell marbles*, like those of Purbeck and Petworth in Dorset and Sussex, receiving their "figure" from the enclosed shells of various mollusca.

Marcasite (said to be from an Arabic word signifying "fire-giving stone").—Iron pyrites, or bisulphide of iron, occurring crystallised in modified rhombic prisms, and also in reniform and botryoidal masses, and in stalactitic crusts; hence such varieties as *hepatic pyrites*, *cockscorn pyrites*, *radiated pyrites*, &c. Marcasite is more liable to decomposition than ordinary pyrites, is of a paler colour, being nearly tin-white, and is more strongly metallic in lustre. Is abundant in nature; used commercially as ordinary pyrites, and sometimes for ornamental purposes. By the older mineralogists the term *Marcasite* was applied to iron pyrites occurring in thin veins, and *Pyrites* to the varieties occurring in nodular masses.—See PYRITES.

Maremma (Lat. *mare*, the sea).—The Italian term for those unwholesome sea-marshes that diffuse with more or less virulence their pestilential exhalations along the whole west coast of Italy.—See PONTINE MARSHES.

Margarite (Gr. *margarites*, a pearl).—One of the Mica family; known also as *pearl-mica*, or *hemiprismatic pearl-mica*. A pearly-grey mineral generally occurring with chlorite in scaly irregular masses, and rarely crystallised in six-sided tables.

Marl (Sax.).—Any soft admixture of clay and lime is termed a marl—"clay-marl" when the clay predominates; "marl-clay" when the lime is most abundant; and "shell-marl" when it contains fresh-water shells, as the *lymnea*, *puludina*, &c. In geological nomenclature we have "chalk-marls," "lias marlstone," and other appropriate enough terms; but occasionally the word is used to designate soft friable clays with which not a particle of lime is intermingled, just as agriculturists call any soil a "marl" that falls readily to pieces on exposure to the air. For *Vari-gated Marls* or *Keuper*, see TRIASSIC SYSTEM.

Marlstone.—In geological classification, the middle member of the Lias formation, ranging in the eastern counties of England (York, Lincolnshire, &c.) from 100 to 150 feet in thickness, and consisting of arenaceous shales, laminated sandy limestones, and several bands of stratified and nodular limestone, the whole series being peculiarly rich in fossils—shells, corals, crustacea, and fishes. "The marlstone beds," says Phillips, "are in fact the first term of the Oolitic deposits, interpolated among the last terms of

the Lias ; and according as the clay above them is attenuated or developed, they may be ranked with the Oolite or Lias formation."

Mármolite (Gr. *marmairo*, to shine, and *lithos*).—A variety of foliated serpentine, of a pale-green, yellow, or light-grey colour.

Marsupíalia, Marsupíata (Lat. *marsupium*, a pouch or purse).—Literally "pouched animals;" an order of mammalia having a sack or pouch under the belly, in which they carry their young, as the kangaroo, wombat, and opossum. They are sometimes termed *ovoviviparous* mammals, as being intermediate between the viviparous mammals and the oviparous birds and reptiles. For the same reason they are classed as *implacentalia*, in contradistinction to the true placental animals—the pouch-like apparatus for their imperfect young being a sort of extra-uterine gestation. Marsupial remains occur in the Oolite and Trias (*amphitherium*, *phascalotherium*, &c.), and, according to American authority, even in the Permian (*dromatherium*), thus making them the earliest mammiferous creatures with which palæontologists are yet acquainted.—See tabulations, "ANIMAL SCHEME."

Marsupite (Lat. *marsupium*, a purse).—A genus of free-floating crinoidea found in the Chalk formation ; having a bag-like shape when closed ; and often known by the quarrymen's term "cluster-stones."—See CRINOIDEA.

Mássicot.—Yellow protoxide of lead. The dross that forms on melted lead exposed to a current of air, and roasted till it acquires a uniform yellow colour. Used as a pigment.

Massospondýlus (Gr. *masson*, longer, and *spondylos*, a vertebra).—A provisional genus of huge fossil saurians, occurring in the Triassic sandstones of South Africa ; and so named by Professor Owen from the length of their vertebrae, the only remains yet discovered.

Master-Joints.—A term applied to the larger planes of division which pass through rock-masses, and which run regularly parallel to each other for considerable distances, in contradistinction to the ordinary and smaller joints which traverse the rocks in all directions. In speaking of these fissures the quarryman employs the terms "backs and cutters"—the former being the master-joints and the latter the smaller and ordinary ones.—See JOINTS.

Mástodon (Gr. *mastos*, nipple, and *odous*, tooth).—A genus of Tertiary and Post-tertiary elephantine mammals ; so called from the nipple-like protuberances on the grinding-surfaces of their molar teeth. According to Falconer, who separates the *Mastodons* from the true *Elephants*, the genus includes "all the elephantoid species which have the crowns of the molars comparatively simple, and uniformly divided into two sub-equal divisions by a longitudinal line or cleft ; the ridges limited in number, each with fewer mammillary eminences, and invariably more or less concave across ; the enamel thick, and in conical or compressed points ; and the valleys between the ridges deep and empty, or with but a sparing quantity of cement." The same authority divides the genus into two sub-genera (*Trilophodon* and *Tetralophodon*), and enumerates upwards of a dozen species, which seem to have had a truly cosmopolitan range during the Pliocene and Post-pliocene periods.—See 'Geological Journal,' vol. xiii.

Mastodonsáurus (Gr. *mastos*, a nipple ; *odous*, tooth ; and *saurus*, lizard).—A provisional genus of saurian reptiles occurring in Triassic strata, and so called from the peculiar form of their teeth—the only portion of their remains yet discovered. Regarded by Owen as the same with LABYRINTHODON, which see.

Mátinal (Lat.)—Appertaining to the morning; the third of the fifteen series into which Professor Rogers subdivides the Palæozoic strata of the Appalachian chain—the “Morning” of the North American Palæozoics, and the equivalents apparently of our Upper Cambrians.—See PALÆOZOIC FORMATIONS.

Matrix (Lat., the womb).—The rock or main substance in which any accidental crystal, mineral, or fossil is imbedded, is said to be the *matrix* of that mineral or fossil.

Meadow-Ore.—A term occasionally used for *bog-iron ore*, from its occurrence in marshy or low-lying meadow-lands.

Meandrina (Lat.)—Brain-coral; madrepores in which the laminae assume a meandering direction. The Meandrines are large hemispherical corals having their surfaces covered with serpentine ridges and depressions, resembling the convolutions of the human brain. They occur abundantly in modern coral-reefs, but seem not to be represented in earlier formations.

Medina Sandstones.—An important group of North American Silurians which, taken in conjunction with the *Oneida Conglomerates*, are believed to be the representatives, in time, of the Lower Llandovery rocks of England—that is, the upper portion of the “Lower Silurian” division of Murchison.

Meerschaum (Ger., sea-scum; sea-foam).—A white, light, earthy or compact hydrated silicate of magnesia—the purer sorts consisting of 50 silica, 25 magnesia, and 25 water. It occurs among the serpentine rocks of several countries, but that used for the bowls of tobacco-pipes comes chiefly from Greece and Asia Minor, and is found in stratified earthy or alluvial deposits. It has a soapy feel, adheres to the tongue, and is usually dull and opaque. Being capable of forming a paste with water, it is sometimes spoken of as “plastic magnesia”—the commoner sorts being used in the manufacture of porcelain, and the finer (after undergoing various processes, such as boiling in milk, &c.) in the making of meerschaum pipes.

Megáceros Hibernicus (Gr. *mega*, great, and *keras*, horn).—Literally, the “great antlered deer of Ireland.” The fossil or sub-fossil gigantic deer of our Pleistocene marls and peat-bogs, often, but erroneously, termed the “Irish Elk.”—See IRISH DEER.

Megalánea.—The name given by Professor Owen to a gigantic sub-fossil land-lizard whose remains have been discovered in the Pleistocene deposits of Australia. These remains indicate an affinity to the existing lace-lizards of that continent, but must have belonged to an animal at least twenty feet in length, and equalling in size the largest crocodiles.

Megalichthys (Gr. *megale*, great, and *ichthys*, fish).—A large sauroid fish of the Carboniferous period, occurring most abundantly in the lower beds, and characterised by its smooth but minutely punctured, enamelled, lozenge-shaped scales. The scales, jaws, and imperfect specimens which have been found in the Coal-measures of Scotland, indicate a fish of great size; but the teeth (which are numerous, sharp, and conical) are small in comparison with those of *holoptychius* and *rhizodus*, with which the remains of *megalichthys* are often confounded.

Megalónyx (Gr. *megale*, great, and *onyx*, claw).—A huge edentate mammal, found chiefly in the Upper Tertiaries of America, and so called from the great size of its claw or ungual bones, the largest of which was about seven inches long. From the admirable inductions of Cuvier and others, it would appear that the *Megalonyx* somewhat resembled the *Megatherium*

in its general character, configuration, and habits, but was a third smaller than that colossal animal.

Megalosaurus (Gr. *megale*, great, and *sauros*, lizard).—One of the Dinosaurs, or gigantic land-saurians, whose teeth, vertebrae, femoral and other bones occur in the Oolite and Wealden strata. In these remains the character of the monitors seems blended with that of the crocodiles; and judging from its decidedly trenchant teeth, the Megalosaurus was highly carnivorous, preying in all likelihood on smaller reptiles, and on the young of its gigantic contemporaries, the iguanodon and hylæosaurus.

Megaphytum (Gr. *mega*, great, and *phyton*, a shoot).—A genus of Coal-measure stems, so called from the large size of their leaf-scars. In megaphytum the stem is not furrowed, but irregularly dotted or rugose; the leaf-scars large, horseshoe-shaped, and arranged on each side the stem in vertical rows. Allied to *Bothrodendron* and *Ulodendron*, and apparently coniferous.

Megathérium (Gr. *mega*, great, and *therion*, beast).—A huge edentate mammal whose remains occur abundantly in the Upper Tertiary or Pampean deposits of South America. In anatomical structure the Megathérium exhibits features intermediate between the Sloths, Armadillos, and Ant-eaters; for while in its skull and shoulders it resembles the former, its legs and feet present an admixture of the characters of the latter. Larger than the largest rhinoceros, its length was about nine or ten feet; but its bones were proportionally much more colossal than those either of the rhinoceros or elephant. The structure of its teeth indicates herbivorous habits, and its powerfully-clawed fore-feet (about a yard in length) seem admirably formed for digging up the succulent roots and luxuriant herbage which would then adorn the fertile surface of the virgin Pampas.

Melinite (Gr. *meion*, less).—Prismatic-pyramidal felspar, occurring in Monte Somma near Vesuvius, and so called from its terminating pyramids being lower or less acute than in Idocrase. Known also as *Wernerite* and *Scapolite*, which see.

Melaconite, Melaconise (Gr. *melas*, black, and *konis*, powder).—An earthy and impure black oxide of copper, occurring in veins in pulverulent masses (whence the name), and arising in all likelihood from the decomposition of other ores.

Melanasphalt.—Literally "black asphalt," the name given by some American mineralogists to the *Albert Coal* or *Albertite* of Nova Scotia, which see.

Mélanite (Gr. *melas*, black).—A variety of iron garnet, so called from its black colour; and, according to Klaproth, consisting of 35.5 silica, 6 alumina, 26 iron peroxide, and 32.5 lime.—See GARNET.

Melanochoïte (Gr. *melas*, black; *chroa*, colour).—Chromate of lead, occurring in rhombic prisms or massive; of a deep hyacinth-red; resinous lustre; and consists of 76.7 protoxide of lead, and 23.3 chromic acid.

Mélanterite (Gr. *melas*, black).—The mineralogical term for the native sulphate of iron, which is a recent production from the decomposition of iron pyrites.

Méllite (Lat. *mel*, honey).—Honey-stone; mellitate of alumina; a rare mineral, of a honey-yellow colour, resinous lustre, and more or less transparent, occurring in connection with Tertiary and Cretaceous lignites. According to Klaproth, it consists of 46 mellic acid, 16 alumina, and 38 water.

Ménilite.—A variety or sub-species of opaline quartz, occurring in compact kidney-shaped nodules, in a bed of adhesive slate at Mont Menil near Paris; hence the name. It is sometimes known as "liver opal," from its brown colour, though varying shades of bluish-grey are not uncommon.

Mephitic (Lat. *mephitis*, an offensive odour).—Offensive to the smell, foul, noxious. Thus *mephitic air*, azote or nitrogen; *mephitic acid*, carbonic acid.

Mercury.—A well-known metal, which is always fluid at a temperature higher than -39° ; and hence, from its mobility and silvery lustre, usually called "*quicksilver*." At temperatures less than -40° it becomes solid, and has a specific gravity of 15.6; when fluid, its gravity is only 13.5; under the blowpipe it is altogether volatile, or leaves a slight residuum of silver. It occurs in rocks of all ages, but is rarely found in a state of native purity—its more abundant ores being *cinnabar* or bisulphuret of mercury; *native amalgam*, an ore consisting of silver and mercury; and *calomel*, or chloride of mercury. The best-known mercury mines in Europe are those of Idria in Carniola, and Almaden in Spain. At Almaden the mercury is said not to form veins, but to have impregnated the vertical strata of quartzose sandstone associated with carbonaceous slates; and in the Asturias the mines are worked in coal strata.

Meridian (Lat.)—Mid-day; the eighth of the fifteen series into which Professor Rogers subdivides the Palæozoic strata of the Appalachian chain—the "Mid-day" of the North American Palæozoics, and the equivalents perhaps of our lowermost Devonians.—See PALÆOZOIC FORMATIONS.

Merycothérion (Gr. *meryko*, I ruminate, and *therion*, beast).—A huge ruminant found along with the mammoth and rhinoceros in the "Drift" or Upper Tertiary beds of Siberia, and having affinity to the existing Bactrian camel.

Meso- (Gr. *mesos*, the middle).—A frequent prefix of scientific compounds, signifying intermediate, or that which holds a middle place between others.

Mesopithecus (Gr. *mesos*, intermediate, and *pithecos*, ape).—A generic term applied by Professor Wagner to the remains of a quadrumanes discovered in the Tertiary formations of Greece, and regarded by him as intermediate between the long-armed apes (*hylobates*) and the tailed monkeys (*semnopithecus*).

Mesostylus.—The generic term for a small crustacean, whose cheliferous claws or pincers occur abundantly in the Chalk formation, and that without any vestige of carapace or body-crust. From this circumstance, as well as from the fact of the right claw always being the largest, it is presumed that the *Mesostylus* had the structure and habit of the living Hermit-crab (*Pagurus*)—viz., an abdomen unprotected by a calcareous crust, which it thrust for shelter into the shells of those molluscs with which its claws are now found associated.

Mésotype (Gr. *mesos*, intermediate, and *typos*, form).—Prismatic Zeolite; a silicate of soda and alumina occurring abundantly in trap-rocks, and known also as *Natrolite*, which see.

Mesozóic (Gr. *mesos*, middle, and *zoe*, life).—The great division of stratified formations holding the middle forms of Life, as differing from the Palæozoic and Cainozoic. The Mesozoic period thus embraces the Triassic, the Oolitic, and Cretaceous systems.

Metallic.—Of, or pertaining to, a metal; partaking of the nature of a

metal. We thus speak of *metallic ores*, *metallic veins*, *metallic lustre*, and so forth—all implying the nature, quality, and characteristics of metals.

Metalliferous.—Literally “metal-yielding;” applied to rocks, veins, and deposits productive of metals or metallic ores.

Metallography.—Literally a description of the metals: that branch of science which treats of the nature and properties of the metals.

Metalloid (Gr. *eidos*, likeness).—A term sometimes applied to the metallic bases of the alkalis and earths, as calcium, potassium, sodium, &c.; and also to the inflammable non-metallic bodies, as sulphur, phosphorus, &c.

Metallurgy.—Literally metal-working; the art of separating the metals from their ores, and comprising the operations of smelting, refining, assaying, and so forth.

Metals (Gr. *metallon*, a mine, metal, or mineral).—A well-known class of elementary bodies, most of which are characterised by their peculiar lustre (*metallic lustre*), and generally speaking by their great specific gravities, some of them being the heaviest substances known. Geologically, few of them occur in a state of purity, or as *native metals*, the most of them being found in the state of *ores*—that is, in combination with other elements, and mixed with various mineral matters. Some occur in beds or strata, most of them in veins; and these veins generally abound in the older rocks, and in districts which have been most subjected to igneous disturbance. Some metals also occur more abundantly in one rock-formation than another, but the causes which have led to this peculiar arrangement are yet unknown. Chemically, it is usual to arrange the metals into different classes, according to their affinity for oxygen, and the peculiar properties of their various oxides. Thus they are distinguished:—1. *Perfect Metals*, or those which combine, with difficulty, with oxygen, and consequently are not easily oxidised; and as such they readily part with oxygen by the simple application of heat, and are converted into pure metals. The best known of this class are platinum, gold, and silver. Mercury holds an intermediate place between these and the next class. 2. *Base Metals*, or those which readily combine with oxygen, partly by mere contact with the atmosphere, or when heated and fused they are not *reducible* by the action of heat only, but require the admixture of some substance, as coal, to attract the oxygen from the oxide. The best known of this class are iron, copper, lead, tin, and zinc. The metals composing this and the preceding class are usually termed, from their great specific gravity, the *heavy metals*. 3. *Acidifying Metals*, or those which, entering into combination with oxygen, possess the property of acids, which are hence called metallic acids. The metals of this class are—tellurium, arsenic, chromium, molybdenum, tungsten, columbium, and selenium. 4. *Terrigenous Metals*, or those whose oxides constitute the *Earths* proper. They resist the action of heat, and are insoluble in water. These are aluminium, yttrium, cerium, lanthanum, thorium, glucinum, and zirconium. And, 5. *Kaligenous Metals*, or those which oxidise most readily, their oxides constituting the *alkalies*. These are magnesium, calcium, strontium, barium, lithium, sodium, and potassium. As the metals of this and the preceding class are some lighter and some little heavier than water, they are usually called the *light metals*.—See tabulations, “CHEMICAL SCHEME,” ORES, EARTHS, and ALKALIES.

Metaméric (Gr. *meta*, implying change, and *meros*, part).—A term applied to compounds in which the ultimate elements are the same as in other well-known combinations, but are considered to be arranged in a

different way; thus, oxygen, hydrogen, sulphur, and a metal may be considered as combined in the form of sulphuretted hydrogen and metallic oxide, or of water and metallic sulphuret.

Metamorphic (Gr. *meta*, change, and *morphe*, form).—Literally "changed in form;" applied to rocks and rock-formations which seem changed from their original condition by some external or internal agency. In geological nomenclature the crystalline stratified rocks—Gneiss, Mica-schist, Clay-slate, &c.—are termed *Metamorphic*, and erected into a separate system. Strictly speaking, "metamorphic" applies to the power or force causing the change; "metamorphism," the process; and "metamorphosis," the result. Hence we ought to speak of *metamorphic* agency, and *metamorphosed* rocks.—See METAMORPHISM.

Metamorphic System.—Although the rocks of every formation may be, and to a great extent often are, subjected to mineral metamorphisms, still in geological classification it is usual to restrict the term "Metamorphic System" to those crystalline schists—Gneiss, Quartz-rock, Mica-schist, and Clay-slate—which underlie all the fossiliferous strata, and in which no trace of organic remains has yet been detected. In grouping these schists it is often difficult to draw lines of distinction between them, and to say where the one ends or the other begins; still, on the whole, it may be received as a truth that Gneiss, or rocks of a gneissic character, occupy the lowest position in the metamorphic system; that these (at least in such typical districts as the Scottish Highlands) are succeeded by a zone of quartzitic compounds; and these again by mica-schists, which graduate imperceptibly into the chloritic and argillaceous slates that cap the series, thus:—

4. CLAY-SLATE—Chloritic and argillaceous slates.
3. MICA-SCHIST—micaceous, talcose, and chloritic schists.
2. QUARTZ-ROCK—quartzitic compounds, generally thick-bedded.
1. GNEISS—gneiss-rock and granitoid schists.

The rocks composing these groups are less or more indurated and crystalline; exhibit, for the most part, cleavage, crumpling, foliation, and other kindred structure; have their lines of stratification indistinct, or often altogether obliterated; and, as sedimentary strata, have evidently undergone some peculiar change in their internal structure. This change, or metamorphism, whether produced by heat, pressure, or chemical agency, has conferred upon them the term of *Metamorphic rocks*; and by this designation they are now generally known among geologists. As strata, they are the deepest or lowest in the crust of the earth, and are therefore regarded as *Primary* or first-formed. They are also known as *Non-fossiliferous*, *Azoic*, or *Hypozoic* strata, from the fact that, with the exception of the Laurentian *exposed*, no distinct traces of plants or animals have yet been discovered in any part of the system. Azoic and Hypozoic are, however, mere provisional terms, the likelihood being that all stratified rocks, no matter how ancient, were originally fossiliferous.—See tabulations, "GEOLOGICAL SCHEME."

Metamorphism (Gr. *meta*, change, and *morphe*, form).—Literally change of form, or transformation. That change of structure or of texture which has been effected on many rocks by the agency of heat, chemical action, or otherwise; as, for example, when chalk is converted into crystalline marble, or sandstone into jaspery quartz-rock. "The problem of metamorphism," we have elsewhere observed ('Advanced Text-Book'), "is alto-

gether a difficult one, and one involving so many questions in the obscurer departments of chemistry, electricity, and crystallography, that geology must rest satisfied, in the mean time, with indicating rather than defining the nature of the operative causes. The most obvious and general of these may be briefly enumerated:—1. *Heat by contact*, as when any igneous mass, like lava, indurates, crystallises, or otherwise changes the strata over or through which it passes; 2. *Heat by transmission, conduction, or absorption*, which may also produce metamorphism, according to the temperature of the heated mass, the continuance of the heat, and the conducting powers of the strata affected; 3. *Heat by permeation of hot water, steam, and other vapours*, all of which, at great depths, may produce vast changes among the strata, when we recollect that steam, under sufficient pressure, may acquire the temperature of molten lava; 4. *Electric and galvanic currents* in the stratified crust, which may, as the experiments of Mr Fox and Mr Hunt suggest (passing galvanic currents through masses of moistened pottery-clay), produce cleavage and semi-crystalline arrangement of particles; 5. *Chemical action and reaction*, which, both in the dry and moist way, are incessantly producing atomic change, and all the more readily when aided by an increasing temperature among the deeper-seated strata; 6. *Molecular arrangement by pressure and motion*—a silent but efficient agent of change, as yet little understood, but capable of producing curious alterations in internal structure, especially when accompanied by heat, as we daily see in the manufacture of the metals, glass, and earthenware. Such are the more general and likely causes of rock-metamorphism, and as it is possible that several of them may be operating at the same time, the student will perceive that no hypothesis that limits itself to any one agent can be accepted as sufficient and satisfactory. Heat and chemical action and pressure are, no doubt, the chief causes of change, and by them we can readily account for new crystalline arrangements in semi-fused masses, for *fractures, joints, and cleavage*, and in a great measure for that flexuring and folding of the stratified laminae known as *foliation*. And if to these we add electricity, and new crystallographic and molecular arrangement under further chemical reaction, we call in a sufficiency of agency, though we may not always perceive the precise modes of action."

Meteoric (Gr. *meteoros*, raised above the earth).—Of or belonging to the atmosphere, and used as synonymous with *atmospheric*. Thus "meteoric erosion," erosion produced by rain, wind, and other wasting and weathering powers of the atmosphere; "meteoric iron," the iron found native in *aërolites* or meteoric stones.

Meteorite (Gr. *meteoros*, raised above the earth).—A general term for any stone or mineral mass which has fallen through the atmosphere, and which, judging from its composition and other properties, does not seem to be of terrestrial origin. Such meteoric masses are of geological interest as having been found in the auriferous drifts of the Ural and Altai ranges. *Meteorites* or *meteoric stones* are perhaps better known by the term *aërolites*, which see.

Métropolis.—A term very frequently employed by naturalists when treating of the geographical distribution of plants and animals. "Generic assemblages of plants and animals," says Edward Forbes, "whether terrestrial or aquatic, whether fresh-water or marine, have their regions, or definite geographical areas: these are what are known as 'generic areas.'"

Each of these has its '*metropolis*' or district of greatest number, either of typical or specific forms; geographical unity seems to be one of the essentials of every generic group."

Meyeria (after Von Meyer).—A small lobster-like crustacean, having its crust highly ornamented with minute bead-like tubercles, and occurring for the most part in the clays and marly beds of the Chalk formation.

Miaskite, Miascite (Miask in Siberia).—A granitic rock consisting of cleavable white felspar (orthoclase), black mica, and greyish or yellowish-white elcölite, with some hornblende and occasionally albite or quartz. It is usually associated with syenite.

Mica (Lat. *mico*, I glisten).—A mineral well known from its metallic lustre, and divisibility into thin glistening plates or scales—these ultimate laminae, according to Haily, being only $\frac{1}{11,000}$ of an inch thick! It enters as a *primary* constituent into granite, gneiss, mica-schist, and other crystalline rocks; occurs also in several trappean and volcanic products; and is sometimes artificially produced on the walls of iron and copper furnaces. As a *secondary* product—derived from the disintegration of the granitic and crystalline rocks—it occurs in many sedimentary strata, as shales and sandstones, giving to them their flaky and laminated texture. In mineralogy it is made the type of a family, which includes the micas proper, talc, chlorite, serpentine, &c.—minerals often differing more in aspect than in chemical constitution. The typical *potash-mica* consists of silica, alumina, iron-peroxide, and potash; *lithia-mica* has less alumina, with lithia and fluoric acid in addition; in *magnesia-mica* the alumina becomes still less, and is replaced by magnesia; while in *pearl-mica* the main constituents are silica, alumina, iron-peroxide, and lime. In the *chlorites* the silica becomes less, and is replaced by a greater percentage of magnesia and iron; while in the softer and soapier *talc* the alumina all but disappears, and is replaced by magnesia. Mineralogically the varieties of mica are known as *Biotite*, *Lepidolite*, *Muscovite*, *Lepidomelane*, &c., which see. In some countries, like Russia and India, the large-plated variety of mica (muscovite) is regularly mined as an article of commerce, being used in the arts and for decorative purposes.

Micaceous.—Applied to rocks and compounds which are mainly composed of mica, or which contain mica in notable proportion; as "*micaceous schistus*," "*micaceous sandstone*," &c.

Mica-Schist (Gr. *schisma*, a splitting).—A metamorphic foliated rock composed of mica and quartz—the two ingredients occurring in alternate folia with greater or less regularity. It is also, but improperly, known as "*mica-slate*"—the schistose structure of a *foliated* rock being very different from the platy *cleavage* of true slate. As a *Rock*, it passes through every stage of metamorphosis from that of a flaggy schist to a highly-crystalline compound almost undistinguishable from gneiss. As a *GEOLOGICAL GROUP*, the mica-schists hold an intermediate place in the Metamorphic System between Gneiss and Clay-slate, often passing into chloritic slate, and being associated with beds of quartzite, serpentine, and crystalline limestone.

Micraster (Gr. *mikron*, small, and *astron*, star).—A genus of *Spatangida* abounding in the Chalk, and so termed from the star-like arrangement of its small or incomplete ambulacral furrows. In *Micraster* the case is somewhat elongated, heart-shaped, and wider before than behind, with a sulcus or furrow in front. "The shell is fragile, and composed of large

polygonal plates; the tubercles small and irregularly distributed; the spines short. The mouth is transverse, situated anteriorly, and protected by a strong projection of the odd interambulacrum, which is named the *lip*. The vent is terminal, and placed above the margin. There are but four ambulacra, and these are incomplete, comparatively of small extent, and situated in deep furrows."

Microlestes (Gr. *micros*, small, and *lestes*, beast of prey).—The generic term applied to a small insectivorous quadruped whose molar teeth and other remains were discovered in 1847 by Dr Plieninger in the bone-breccia of Würtemberg—a stratum which occurs among the upper beds of the Keuper, and occupying nearly the same place in the Triassic system as the celebrated "bone-bed" of Aust and Axmouth.

Microphyta, Microphytes (Gr. *micron*, small, and *phyton*, plant).—Literally "minute vegetables;" a term applied to those microscopic forms usually known as DIATOMACEÆ, and which at one time were confounded with the INFUSORIA, or minute forms of animal life. It has been proposed by Dr Mantell to substitute the term *microphytal* for that of *infusorial*, where deposits are chiefly of vegetable origin, and not of animal, as was originally supposed by Ehrenberg, who regarded the "polishing-slate" of Bilin, the "berg-mahl" of Tuscany, and the "Richmond-earth" of Virginia, as of infusorial origin.

Microzoa (Gr. *micron*, small, and *zoon*, animal).—A convenient term to denote minute animal organisms whose forms can only be defined by the aid of the microscope, and this without reference to their exact place in zoological classification. The contradistinguishing term to *Microphyta*, which refers to minute vegetable organisms.

Middletonite.—A mineral resin found in the older Coal formations, and occurring in layers or in rounded pea-like masses of a reddish-brown colour, resinous lustre, brittle, but easily sectile. So called from Middleton Collieries, near Leeds, where it was first discovered between the layers of the coal. Consists of 86 carbon, 8 hydrogen, and 5.5 oxygen.

Mile.—A well-known unit of measure, of which there are two kinds—1, the *Geographical* or *Nautical Mile*, 60 of which are equal to one degree of latitude; and 2, the *Common* or *Statute Mile*, 69½ of which are equal to one degree. The geographical mile is about 6079 English feet; the statute mile, 5280 feet.

Miliola.—A genus of minute foraminiferous shells, so called from their occurring in myriads in certain tertiary strata. The *Miliolite Limestone*, which belongs to the "calcaire grossier" group of the Paris basin, is almost entirely made up of these many-chambered microscopic shells, and is the principal building-stone employed in the French capital.

Milk-Quartz.—A compact vitreous variety of quartz, occurring in veins of the older rocks, of a milk-white colour, and somewhat greasy lustre whence known also as *Greasy Quartz*.

Millepora, Milleporides (Lat. *mille*, a thousand, and *pore*, a pore or passage).—Literally "thousand-pore;" a genus and family of branching corals, whose cells or pores are minute, distinct, and perpendicular to the surface, giving to the interior a finely striated fracture, disposed somewhat irregularly. Species of Millepores occur fossil from the Silurian upwards.

Millerite (after Prof. Miller of Cambridge).—Sulphide of nickel, occurring in delicate, six-sided prisms, or in diverging filaments, of a bronze-yellow, with a grey or iridescent tarnish, metallic lustre, and brittle.

Millstone Grit.—A group of the English Carboniferous system, so called from its hard gritty sandstones being extensively used for millstones. In the eastern and northern counties the *Millstone Grit* immediately underlies the true Coal-measures, and passes downwards through a series of thick-bedded sandstones, shales, thin coals, and calcareous bands, into the Carboniferous Limestone below. Known as the "Farewell Rock" in the Welsh coal-fields, from the fact that the miner striking it bids farewell to profitable seams of coal.

Mimetic (Gr. *mimetikos*, imitative).—Applied in natural history to organs, &c., which in one plant or animal bear a close resemblance to those possessed by some other belonging to a distinct group. Organs "imitating," as it were, those that are regarded as special to, or characteristic of, another group or family. The term seems more applicable to habits and actions than to mere structural forms.

Mimetite, Mimetesite (Gr. *mimetes*, imitator).—Arsenate of lead, usually containing a small percentage of chloride and phosphate of lead; occurs in regular six-sided prisms, also fibrous and mammillary; of a yellowish-brown colour, resinous lustre, sectile, but brittle. So called from its resemblance to pyromorphite, with which it is isomorphous.

Mimosites.—The term applied to fossil seed-pods apparently belonging to plants of the *Mimosa* family. They occur in the London Clay, and in other Tertiary strata.

Mine.—The familiar as well as technical term for any system of subterranean work or excavation which has for its object the discovery and extraction of the metallic ores or other mineral produce, as coal, rock-salt, &c. **Mining.**—The art or systematic management of a mine in all that relates to winning, draining, ventilating, and the like.

Mineral.—Literally, any substance obtained from the earth's crust by *mining* or digging. The term, however, is used adjectively as well as substantively; hence we speak of the "mineral kingdom" in contradistinction to the animal and vegetable kingdoms, and in this sense it is equivalent to *inorganic* as contrasted with *organic*. We also speak of "mineral oil" in contradistinction to animal or vegetable oil; and of "mineral green" as distinguished from vegetable green. Substantively a MINERAL is regarded as an inorganic substance, the product of chemical or physical forces, in contradistinction to substances resulting from the operations of vitality; and yet coral-reefs and shell-beds, peat-mosses and coal-seams, become "minerals" when entering into the composition of the earth's crust. In the stricter language of mineralogy, a "*mineral species*" is a substance whose form, chemical composition, and physical properties, are sufficiently uniform and persistent as to permit of identification, as diamond, rock-crystal, garnet, and so forth. In this sense also geologists speak of "*simple minerals*"—meaning thereby the primary constituents of rock-masses. Thus ordinary granite, as a compound rock, consists of the simple minerals, quartz, felspar, and mica, though, chemically speaking, each of these is composed of several elementary ingredients.

Mineralisation.—The process of converting any substance into a mineral; as vegetable matter into coal, animal fibre into adipocere, or a metal into an oxide, sulphuret, or other ore. Mineralisation is strictly dependent on chemical changes, brought about by the natural action and reaction of substances one upon another, when placed in conditions favourable to such reactions.

Mineralogy.—Literally “the science of minerals;” that branch of knowledge which investigates the qualities of, describes, and classifies the various mineral substances which enter into the composition of the crust of the globe. In describing and classifying minerals we may be guided either by their chemical composition, by their crystallographic forms, or simply by their physical properties of colour, lustre, hardness, fracture, and so forth; hence we hear of the “*system*” of this author, and the “*system*” of that, according as they may have adopted one or other of these methods of discrimination. As yet the science of mineralogy, notwithstanding the sound progress which has been made of recent years, is in a very unsatisfactory state—cumbered by synonymes, overloaded with subdivisions into so-called “*species*,” and devoid of that unity of nomenclature which makes the terms employed express a portion of the information attempted to be conveyed.—See CRYSTALLOGRAPHY.

Mineral Blue.—The name usually given to *azurite* when reduced to an impalpable powder for colour purposes.

Mineral Caoutchouc.—Known also as *elaterite*, or elastic mineral pitch; a variety of bitumen resembling caoutchouc in elasticity and softness.—See ELATERITE.

Mineral Charcoal.—This term is usually applied to those silky fibrous layers of charcoal which are interlaminated in beds of ordinary bituminous coal, and which give to it its staining or blackening properties. These layers seem to have arisen from some process of spontaneous combustion during the mineralisation of the vegetable mass, whereby their volatile products have been expelled, and the carbon of the ligneous fibre left behind. Known to the miners as “mother of coal.”

Mineral Oil.—A familiar term for petroleum or rock-oil, which is found oozing out from strata of all ages from the Silurian and Devonian upwards, and appears to be the result of the decomposition of marine and land plants (mainly the latter), and perhaps also of some non-nitrogenous animal tissues.—See PETROLEUM.

Mineral Tallow.—A familiar term for *Hatchetine*, in allusion to its fatty or spermaceti-like appearance.—See HATCHETINE.

Miocene (Gr. *meion*, less, and *kainos*, recent).—Sir Charles Lyell’s term for the Middle Tertiaries, as holding a less percentage of recent shells than the Pliocene or Upper Tertiaries. In 1830, when the terms were introduced, the percentages were *Pliocene*, 35 to 50; *Miocene*, 17; and *Eocene*, 34.—See TERTIARY SYSTEM.

Mirage (Fr.)—A meteorological phenomenon occurring most frequently on level tracts and during hot weather, and occasioned partly by the unequal rarefaction of the vapour of the atmosphere, and partly by the intermixture of strata of air having different temperatures and densities. It assumes the appearance of a lake-like sheet of water, often exhibiting the reflected or inverted images of distant objects.—See FATA MORGANA.

Mispickel (Gr. *mysy*, a kind of pyrites).—Arsenical pyrites; an arsenide with sulphide of iron, consisting of 36 iron, 43 arsenic, and 21 sulphur, and occurring either crystallised in rhombic prisms, or more frequently massive, acicular, and columnar, in connection with iron or copper pyrites, with ores of zinc, tin, lead, and silver. It is of a tin-white colour, strong metallic lustre, brittle, and very hard; and is worked as an ore of arsenic.

Mist.—The term applied to atmospheric vapour when it becomes visible

in consequence of a reduction of the temperature of the air. *Mists, fogs, fairs*, and the like, are common phenomena in insular and estuary-intersected countries like Great Britain and Ireland.

Mithracites.—A provisional genus of brachyurous crustaceans found in the Lower Greensand of England, and so termed from their general resemblance to the *mithracia* of the London Clay. The genus is characterised by its well-defined carapace, pointed rostrum, and shallow orbits, having the under edge anterior to the upper.

Moa.—The Maori or native name for the *Deinornis* or gigantic extinct cursorial bird of New Zealand, which see. According to native accounts the moa was recently alive, if not still existing in the remote interior; but of its comparatively recent extirpation we have evidence in the fact that its bones have been found along with charred wood, showing that it had been killed and eaten by the inhabitants.

Mocha Stone.—A variety of dendritic or moss agate, so called from its being found in abundance near Mocha in Arabia. The dendritic lines and patches, being of a dark colour, are finely shown off in the glassy translucent matrix of the agate.—See AGATE.

Modiola (Lat. *modiolus*, a small measure).—A genus of bivalves belonging to the family Mytilidæ, but distinguished from the mussels by their habit of burrowing or spinning a nest. The living species are chiefly tropical; the fossil occur in all formations from the Silurian (?) upwards. The name has reference to the shape of the shell, which is oblong and inflated in front.

Modiolopsis (Gr.)—Literally “modiola-looking;” a genus of fossil conchifera occurring in Silurian strata and sometimes known as *mytiloides*. Shell like *modiola*, thin and smooth, front end somewhat lobed; anterior adductor scar large and oval.

Molar (Lat. *mola*, a mill).—The molar or grinding teeth of mammals; so termed from their function of milling or grinding the food before it is fit to be swallowed. The shape of the molars differs in the different tribes of animals according to the nature of the food they consume, and the kind of work they have accordingly to perform. Thus in the carnivorous or flesh-feeding tribes they are raised into sharp prongs, and often serrated edges, for cutting; in the insectivora they are furnished with rounded tubercles for bruising and pounding; and in the graminivorous and herbivorous races they have flattened surfaces more or less rough for the purpose of simply grinding or milling. These distinctions afford important aid to the discriminations of the palæontologist.—See ODONTOLOGY.

Molasse (Lat. *mollis*, Fr. *mol*, soft).—A provincial term for those soft arenaceous beds which constitute the Middle Tertiaries of Switzerland. This deposit, occasionally alternating with lignite, but generally composed of incoherent greenish sandstone, is thickly developed in the great Swiss valley, and spreads also over large tracts in France, overlying the other and better-known Tertiaries. The Molasse comprises three divisions, an upper fresh-water, a middle marine, and lower fresh-water, which is of older Miocene age.

Molecular Attraction.—In natural philosophy, that force or attraction by which the particles or molecules of bodies are kept together *en masse*, as distinguished from the attraction or force of gravitation. “According to the molecular theory,” says Hoblyn, “all bodies are viewed as aggregates of minute particles or molecules, and are formed by the attractive

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and repulsive forces acting on these molecules, at immeasurably small distances."

Molecule (diminutive of *moles*, a mass).—Any minute particle of matter; the ultimate visible particles of which any body or mass is composed, are usually termed *molecules*.

Mollusca (Lat. *mollis*, soft).—One of Cuvier's grand divisions of the Animal Kingdom, including all the "shell-fish" proper, and having reference to the circumstance that these creatures have *soft* bodies, unsupported by any internal or tegumentary framework of sufficient density to merit the name of skeleton. The term has been much objected to, but the words *mollusc*, *mollusca*, and *molluscons*, are now too thoroughly incorporated with the language of zoology and palæontology to be readily abandoned. Since Cuvier's time the meaning of the term has undergone some modification, and it is now common to speak of the **MOLLUSCA** and the **MOLLUSCOIDA**—the former embracing the "shell-fish" proper; the latter, those which have only coriaceous or horny integuments; thus—

MOLLUSCA.	Cephalopoda—cuttle-fish, calamary, nautilus.
	Pteropoda—hyalea, clio.
	Gasteropoda—snails, slugs, whelks, cowries.
	Acephala—oysters, mussels, shipworms.
	Branchiopoda—terebatula, lingula.
MOLLUSCOIDA.	Tunicata—biphora, simple and compound ascideans.
	Polyzoa or Bryozoa—plumatella, flustra, eschara.

The shells and frameworks of most of the mollusca being calcareous and readily preserved, and each family having its own habitat as to depth, nature of sea-bottom, and the like, their remains become important aids to the geologist in the solution of his problems.—See tabulations, "ANIMAL SCHEME."

Molluskite.—A dark-brown carbonaceous substance occurring in shelly marbles, and originating from the mineral transmutation of the soft bodies of the mollusca. Speaking of the Sussex marble, which is chiefly composed of paludine (river-snails), Dr Mantell observes—"Those shells which were empty at the period of their becoming imbedded had their cavities filled with mud, silt, or other detritus, which has subsequently hardened into clay, marl, limestone, &c., but those which contained the gelatinous bodies of the snails are occupied by a mass consisting of carbon and a large proportion of phosphate of lime. In the polished sections of the marble, this carbonaceous animal matter often appears in black or dark-brown spots and veins; and the most beautiful slabs owe their variegated appearance to the contrast produced by the *molluskite* with the white calcareous spar."

Molybdenite.—Sulphuret of molybdenum; molybdena-glance; an ore found in various rocks, as granite, gneiss, and chlorite slate, and in veins with tin and other ores. It much resembles graphite, but is readily distinguished by its streak, lustre, and action before the blowpipe. It is used for preparing a blue pigment for pottery ware.

Molybdenum (Gr. *molybdos*, lead).—A very rare metal, discovered by Hielm in 1782, of a whitish colour, brittle, very infusible, and having a specific gravity of 8.625. It derives its name from the resemblance of the native sulphuret (*molybdenite*) to that of lead.

Mon-, Mono- (Gr. *monos*, single) —A common prefix derived from the

Greek, and signifying singleness or unity; as *monolith*, a monument composed of a single stone; *monoceras*, having one horn; *monocotyledonous*, possessed of a single cotyledon or seed-lobe.

Monad (Gr. *monas*, an atom).—The smallest of all visible animalcules, and sometimes spoken of as constituting "the ultimate term of animality." According to Ehrenberg, monads have an average diameter of not more than 24,000th of an inch, so that 500,000,000 of them might be contained in a single drop of water.

Monoclinal (Gr. *monos*, single, and *klino*, I bend).—Applied to strata that dip for an indefinite or unknown length in one direction, and which do not apparently form sides of ascertained *anticlines* or *synclines*. Monoclinical strata often form series of hills—the abrupt outcrops constituting ridges which follow each other like the teeth of a saw.

Monocotyledonous (Gr. *monos*, one, and *cotyledon*, seed-lobe).—A grand division of the vegetable kingdom, comprising all those plants whose seeds have only one lobe or seed-leaf. They are *endogenous* in growth, or increase from within like the palms, lilies, grasses, &c., and are characterised by a parallel venation of the leaves.—See tabulations, "VEGETABLE SCHEME."

Monograph (Gr. *monos*, sole, and *graphe*, description).—An account or description of a single object or class of objects; as a *monograph of the mastodon*; a *monograph of the mollusca*; the *monographs of the Palæontological Society*.

Monogrâpsus (Gr. *monos*, single, and *grapho*, I write).—A term proposed by Geinitz to embrace all those graptolites with a single row of teeth-like cells, as *rastrites*, *graptolithus*, &c., which see.

Monolith (Gr. *monos*, single, alone, and *lithos*).—A pillar, obelisk, or other monument, consisting of a single stone. Many of the Egyptian monuments were of this *monolithic* character.

Monomyaria (Gr. *monos*, single, and *mys*, a muscle).—A term employed by Lamarck to distinguish those bivalves whose shell is closed by a single adductor muscle, in contradistinction to the *dimyaria*, or those having a second adductor. The monomyaries are the oysters, aviculids, and clamshells.

Monoprion (Gr. *monos*, alone, single, and *prion*, a saw).—Barrande's term for the common graptolite, its toothleted cells being arranged, like the teeth of a saw, all on one side.

Monsoons (Arabic, *moussin*, season).—The periodical or seasonal winds of the Indian Ocean—the south-west monsoon blowing, in general terms, from April to October; and the north-east, from October to April. The alternate heating and cooling of the African and Asiatic continents during the southern and northern summers are the prime producers of these periodical air-currents.

Monte Bolca, near Verona, in Italy; a locality celebrated for its fossil fishes, which are found in a fissile, cream-coloured limestone of Upper Tertiary age—the deep-brown, semi-bituminous colour of the organisms contrasting finely with the lighter hue of the matrix. According to Agassiz, the species, though related to those still existing, are all extinct; and from the immense numbers imbedded in so limited an area, it is conjectured that the limestone had been erupted as a calcareous mud by volcanic agency, and thus suddenly suffocated the fishes within its influence.

Moonstone.—A fine variety of adularia felspar, so called from the pale-blueish opalescence it exhibits when cut *en cabochon*. The rough mineral is

said to constitute the famous *petunse* or vitrifying ingredient of the Chinese porcelain.

Moraines.—The name given in Switzerland to the longitudinal mounds of stony detritus which occur at the bases and along the edges of all the great glaciers. The formation of these accumulations is thus explained by Professor Agassiz:—The glaciers, it is well known, are continually moving downwards, in consequence, probably, of the introduction of water into their fissures, which, in freezing, expands the ice; and the ice being thus loosened or detached from the rocks on which it rests, is gradually pressed forward by its own weight. In consequence of this motion, the gravel and fragments of rocks, which fall upon the glaciers from the sides of the adjacent mountains, are accumulated in longitudinal ridges or *moraines* as the glacier melts away. There are thus two sets of moraines—viz., “lateral” and “terminal,” the former flanking the margins of the glacier in its downward course in *long narrow spits*, the latter occurring in *mounds* at the free edge or terminus that projects into the valley below. As the terminus advances and retreats according to the nature of the seasons, there will often be several terminal moraines arranged in concentric form; and this disposition of gravel-mounds is very observable in all mountainous regions, either now or during former epochs, the theatres of glacial phenomena. Where the lateral moraines exhibit a terraced appearance, it proves a gradual diminution of the glacier—each shelf or terrace marking a former surface-level.—See GLACIER.

Morass (Sax.)—A marsh, swamp, fen, or tract of low wet ground whose drainage is insufficient, either from its depressed area or from its uniform flatness. Marshes of this kind are often partially silted-up lakes, and contain in their accumulations the usual remains of lacustrine areas. Occasionally they occupy estuarine areas, in which case they are “salt-marshes,” and contain the remains both of marine and terrestrial plants and animals.—See SWAMP.

Morphology (Gr. *morphe*, form, and *logos*, discourse or reasoning).—Literally “the science of form;” that department of biology which treats of living beings as possessing definite forms, which, in most instances, are found to be made up of a number of dissimilar parts or *organs*. Physiology, in contradistinction to Morphology, takes cognisance of the vital actions or *functions* which those organs perform.

Mortar.—The term applied by builders to the well-known admixture of slaked lime and siliceous sand, with which they cement or bind together the stones and bricks of their buildings. Like other hydrates of lime, mortar, if well prepared, “sets” readily, and acquires great hardness and durability.

Mossesaurus.—A gigantic marine reptile of the Upper Chalk, apparently intermediate between the monitors and iguanas; and so called from its being first found in the Maestricht beds. The jaw of the Maestricht animal is 3 feet 9 inches long, and the entire length of the skeleton is estimated at 24 feet—the head being thus about one-sixth of the whole length. In this respect it resembles the crocodiles more than the monitors; but in the shortness of the tail it is altogether unlike the crocodiles and alligators. Its extremities are imperfectly known, but those attributed to the *mossesaurus* would indicate swimming rather than progression on land; hence the inference of its marine nature.

Moss Agate.—A variety of agate which, on being cut and polished, ex-

hibits numerous minute dendritic branchings of various shades like the filaments of moss ; hence the name.—See AGATE.

Mother of Coal.—The name given by the miners to the fine silky-fibrous laminae of carbon or mineral charcoal, which occur imbedded in the seams of ordinary coal.—See MINERAL CHARCOAL.

Mountain.—In physical geography, any portion of the earth's crust rising considerably above the surrounding surface. The term is usually applied to heights of more than 2000 feet, all beneath that amount being regarded as *hills*, and when of inconsiderable height, as *hillocks*. A *Mountain-Chain* or *mountain-range* is a series of elevations having their bases in contact, and their axis continuous over a considerable extent of country, as the Grampians, Urals, Himalayas, &c. Their summits are distinguished by such terms as *cones*, when gradually tapering to a point ; *domes*, when more massive and rounded ; *peaks*, when abrupt and insulated ; and *needles* or *aiguilles*, when still more pointed and detached. As mountain-ranges exercise very decided influences on the natural history of the globe, and as they extend in directions more or less definite, various theories have been advanced to account for their upheaval, their parallelism, and geographical connection, and also to determine their age or relative antiquity. Thus, as their central masses generally consist of igneous rocks which have been protruded from below, and as this protruding force must have acted along the line of least resistance, the question arises, What is the determining cause of these directions ? According to Elie de Beaumont, every system of mountains occupies a portion of a great circle of the globe—the cleft being more easily made in that than in any other direction ; and he shows that the mountain-chains of the same age are parallel to one another, even when in opposite hemispheres. Mr Hopkins, treating the subject from a purely mathematical point of view, has also shown that when the upheaving force acts on a single point, the lines of upheaval must radiate from that point ; hence lofty central mountains with diverging spurs. He also shows that when the expansive force acts uniformly over a wide area, the lines of greatest tension or upheaval must be in the direction either of the length or breadth of the area, and that if the crust yields in more places than one, the fissures would necessarily be parallel. Proceeding upon these views, the various mountains of the world have been so far arranged into "Systems ;" and their relative antiquities determined partly by these means, and partly by the stratified rocks which had been broken through, and which now flank their declivities. Of course this uniformity of system has been considerably obscured, if not modified, by subsequent geological changes ; and we can only accept such generalisations as initiatory steps towards the elucidation of one of the most important problems connected with the history of our globe.

Mountain-Blue and **Mountain-Green.**—Familiar terms for the blue and green carbonates of copper ; the epithet "mountain" being at one time very much used as synonymous with "mineral."

Mountain-Cork, **Mountain-Leather**, &c.—Asbestos, as it occurs in veins and crevices, often assumes very curious appearances ; hence the light elastic variety is known as *mountain-cork* ; the tough variety as *mountain-leather* ; the woody-fibrous looking variety as *mountain-wood* ; and when it occurs in thin papery pieces, it is known as *mountain-paper*.—See ASBESTOS.

Mountain Limestone.—An early, and still used, term for the Carboni-

ferous Limestone, from its being frequently thrown up in thick bluffs or scars on the flanks of such hills as those of Yorkshire and Derbyshire, and in contradistinction to the comparatively low-lying strata of the Lias and Oolite Limestones.—See CARBONIFEROUS SYSTEM.

Mountain-Meal.—An infusorial earth, usually and better known perhaps as *Bergmahl*, which see.

Mountain-Soap.—A variety of soapstone or silicate of magnesia found in the Isle of Skye, and used in crayon drawing.

Mountain-Tallow.—Another name for *mineral tallow*, or *Hatchetine* (which see); terms which include several waxy or tallow-like mineral substances, concerning whose nature and origin very little is yet known.

Moya (Span).—A term applied in South America to the fetid sulphurous mud discharged by certain volcanoes; the *Koth* of the natives.

Muck (Sax).—A familiar term for manure; but applied also (especially by American geologists) to those impure earthy varieties of peat, bog-earths, and swamp-earths, which are employed as manures, and consist largely of decomposed vegetable matter.

Mud (Gr. *mudos*, moistness).—The familiar as well as scientific term for all wet slimy debris, whether produced by rains on the earthy surface, by sediment from turbid waters, or by ejections from springs and volcanoes. Mud may thus be argillaceous, calcareous, sulphurous, or otherwise, according to every notable ingredient which enters into its composition. Consolidated mud becomes *shale*, and this assumes a less or more laminated structure according to composition, age, pressure, and other conditions to which it has been subjected.

Mudstone.—A term originally applied by Sir R. Murchison to certain dark-grey, fine-grained, shivery shales of the Silurian system in Wales, which, on being exposed to the atmosphere, are rapidly decomposed and converted into their primitive state of mud; but now extended to all similar shales in whatever formation they may occur.

Mud, Volcanic.—See MOYA and CANGAUA.

Muller's Glass.—Another name for glassy opal, or *hyalite*, which see.

Multivalve (Lat. *multus*, many; *valva*, valves or folding doors).—Shells composed of more valves or pieces than two (as the Clinton) are said to be *multivalve*, in contradistinction to *univalves*, which consist of one piece, and *bivalves*, which have two. Linnaeus arranged the Testacea into these three great sections, univalve, bivalve, and multivalve—embracing under the last the barnacles, &c., which are not Mollusca, but belong to the Articulata.

Murchisonia (after Sir R. Murchison).—An elongated spiral shell, having the outer lip deeply notched, as in the *Pleurotomaria*. Of Murchisonia (family *Haliotidae*) about fifty species have been enumerated, and these occur in the Silurian, Devonian, Carboniferous, and Permian formations.

Murchisonite (after Sir R. Murchison).—A golden or greyish-yellow variety of felspar from the granite of Arran, and from the New Red Sandstone conglomerate of Dawlish in Devonshire.

Muriacite, Muriasit.—A term usually applied to the crystalline varieties of anhydrous sulphate of lime, or *anhydrite*, which also occurs in granular, fibrous, compact, and fibro-compact masses.—See ANHYDRITE.

Muriate (Lat. *muria*, brine).—Murates are salts formed by the combination of muriatic or hydrochloric acid with a base, as *muriate of soda*, *muriate of iron*, &c.

MUR — MYL

Muriatic Acid (*muria*, brine).—Known also as *hydrochloric acid*; an acid consisting of chlorine and hydrogen, and occurring abundantly in sea-water, in combination with soda and magnesia—common salt being a "muriate of soda."

Muricarbonate (*muria*, brine, bitterness; and *calx*, lime).—Another name for *rhomb-spar*, or *bitter-spar* (which see); a mineral consisting of the carbonates of lime and magnesia.

Múridæ (Lat. *mus*, *muris*, a mouse).—The Rat family; a well-known tribe of Rodents, including the mice, rats, water-voles, &c. Their remains are found in the bone-caves and deposits of the Pleistocene epoch.

Múriiform (Lat. *murus*, a wall, and *forma*, likeness).—Wall-like; a term applied to tissues and organic structures presenting the appearance of bricks in a wall; e.g., the *muriiform tissue* which constitutes the medullary rays in plants.

Múschelkalk (Ger).—Literally "shell-limestone;" the middle member of the Triassic system as it occurs in Germany—the Trias consisting of the *Keuper*, *Muschelkalk*, and *Bunter-sandstein*. The *muschelkalk* is wanting in England, but constitutes the *calcaire coquillier*, the *calcaire à ceratites*, or the *terrain conchylien* of French geologists. In Germany it consists chiefly of a compact greyish limestone, but includes beds of dolomite in many places, together with gypsum and rock-salt. It is rich in fossil shells, as the name implies—the *ceratite*, *posidonia*, and *avicula* being the prevailing forms.—See TRIASSIC SYSTEM.

Múscites (Lat. *muscus*, moss).—A general term for fossil plants of the Moss family, which as yet have been found only in amber, and in certain fresh-water Tertiary strata.

Múscovy Glass.—A familiar term for a variety of mica (*muscovite*), most of the large plates used in the arts being brought from Eastern Russia, where they are employed as a substitute for glass.—See MICA.

Musk-Ox.—Properly the "musk-buffalo" (*Bubalus Moschatus*); a living Arctic form whose remains occur in the "Drift" of middle and southern Europe.—See BUBALUS.

Mússel-Rind, Mússel-Band.—A miner's term for thin shelly bands, calcareous and ferruginous, that occur in the Coal-measures. They are almost entirely composed of shells resembling the existing fresh-water mussels, the *anodon* and *unio*.

Mýadæ, Mýácidæ (Gr. *myaz*, the gaping mussel).—A family of conchiferous molluscs, generally known as the Gaping Bivalves, named from the genus *mya*, and having the valves less or more gaping at one or both extremities. It includes the *mya*, *corbula*, *neara*, *thetis*, *panopea*, *saxicava*, &c., many species of which are fossil as well as recent.

Myliobátis (Gr. *mylias*, a millstone, and *batis*, the thorn-back, a species of skate or ray, from *batia*, a bramble).—A genus of rays (the *Eagle-rays*) characterised by the extraordinary development of the median teeth in both jaws. Instead of pointed teeth, they have wide, flat, tessellated dentary plates in each jaw, composed of distinct pieces, juxtaposed and connected by their margins, and united by fine sutures. These "milling" or "grinding" teeth occur abundantly in Tertiary strata—about twenty species having been found in the Isle of Sheppey, &c., while only five species of existing *Myliobates* are known.

Mýlodon (Gr. *mylos*, a mill, and *odous*, tooth).—A gigantic edentate animal from the Upper Tertiaries of America, and so called in allusion

to the flat grinding surfaces of its molar teeth. There is a skeleton of the *Myloodon* in the Hunterian Museum, London, almost as perfect as if the animal had been but recently buried, and its bones dug up entire. It is eleven feet long from the muzzle to the extremity of the tail ; thus indicating a size as large as that of the hippopotamus, with the bones more than proportionately massive. The *Myloodon*, like the *Megatherium*, was a vegetable feeder ; and from the conformation of its fore feet and arms, which are fitted for grasping and wrenching, as well as that of its hinder extremities and strong thick tail, which seem adapted for supporting the body in an upright position, it is supposed that it sat in this position stripping the trees of their leaves and succulent branches.—See Owen's 'Memoir on the Hunterian Skeleton,' published in 1842.

Myócaris (Gr. *mys*, *myos*, a bivalved-shell, and *karis*, shrimp).—A provisional genus of Silurian bivalved crustaceans, somewhat resembling *Ceratiocaris* (which see), but more obtusely truncate in front, and furnished with two strongly projecting ridges which terminate in pointed processes behind. The valves (the only portions yet known) are marked with concentric striae somewhat sparsely and indistinctly displayed.—Salter in 'Geol. Magazine,' vol. i. page 11.

Myriacanthus (Gr. *myria*, innumerable, and *akantha*, a thorn or spine).—Literally "many-spined ;" a genus of fossil rays whose ichthyodorous, or serrated spines, occur abundantly in the Lias formation of England.

Myriápoda (Gr. *myria*, innumerable, and *pous*, *podos*, foot).—An order of articulate or annulose animals, including the centipedes and millepedes, and represented by the *scolopendra* and *julus*. They are so called from the numerous segments of the body being each provided with one or more pairs of jointed ambulatory feet.

Myriophyllites (Gr. *myria*, innumerable, and *phyllon*, leaf).—Coal-measure stems, or rather roots, surrounded, as the name implies, with numerous fibres. Regarded by Lindley as "aquatic plant roots," though by others ranked as having affinity with *Haloragææ*.

Myripristia (Gr. *myriot*, many, and *pristis*, sawing).—A genus of fossil fishes of the Perch family occurring in the London Clay, and so called from their peculiar dentition.

Mytiláceæ (Lat. *mytilus*, the sea-mussel).—The Mussel tribe ; also known as the MYTILIDÆ or mussel-family—an extensive group of conchiferous molluscs, including the genera *mytilus*, *myalina*, *modiola*, *lithodomus*, *crenella*, &c., many species of which are fossil as well as recent. Their shells are equivalent, oval or elongated, closed, umbones anterior, furnished with a thick epidermis, more or less pearly within, and have the hinge edentulous. Shells undetermined, but, approaching in form to that of the *mytilus* or common mussel, are said to be *mytiloid*.

N

Nacreous (Fr. *nacre*, mother-of-pearl).—Applied to shells and minerals which have a pearly or iridescent lustre like mother-of-pearl. The nacreous portion of some shells (the ammonite, for example) is still preserved in a fossil state.

Nácrité (Fr. *nacre*, mother-of-pearl).—A mineral of the Mica family, having a pearly lustre, massive, and of a fine scaly texture. When rubbed between the fingers it leaves a pearly gloss. *Talcite*, *earthy-talc*, and *pholerite*, are occasional synonymes. Consists of 41.78 silica, 43.10 alumina, and 15.12 water.

Nadir (Arabic, down).—As the *zenith* is that point of the heavens directly above the head of a spectator, so the *nadir* is that point diametrically opposite, or vertically beneath his feet. In other words, they are the opposite poles of the visible horizon.

Nagelfluhe or **Nagelfluhe** (Ger.).—A provincial Swiss term for a soft arenaceous-calcareous conglomerate, occurring among the Middle or Miocene Tertiaries of the Alps, and said to derive its name from the enclosed pebbles appearing like swarms (*fluge*) of nail-heads (*nägel*) in the mass. It is termed *gompholite* or nail-stone by Brongniart, and sometimes attains the truly wonderful thickness of 6000 or 8000 feet, as in the Rigi near Lucerne, and in the Speer near Woren.

Nágyagite.—Foliated tellurium; a mineral consisting of tellurium and lead, with traces of gold, silver, copper, and sulphur. So called by Haidinger from its occurring in veins with gold and other ores at Nagyag in the Siebenberg.

Naiades (*Naias*, a water-nymph).—The fresh-water mussels or UNIONIDE, which see.

Naker Feldspar.—Pearly felspar; a mineralogical term somewhat loosely applied to varieties of adularia, moonstone, aventurine, and other pearly felspars.

Náphtha.—A variety of bitumen (which see), thin, volatile, fluid, and highly inflammable. Springs of it exist in many volcanic countries, and in most districts where coal strata seem undergoing a slow natural process of distillation. One of the finest and purest varieties is that obtained from Baku and Scamachia on the western shores of the Caspian, where it rises from calcareous rocks in the state of an odorous inflammable vapour, or is collected in shallow wells. Naturally it is of a yellowish colour, but may be rendered colourless by distillation. Its specific gravity is about .75; it boils at 160°; and appears to be a pure hydro-carbon—100 parts consisting of about 83 carbon and 15 hydrogen. Most of the naphtha of commerce is obtained by distillation from coal-tar, or directly from coal. Used largely as a solvent for caoutchouc.

Náphthaline.—A soft, greyish-white, flaky crystalline substance found incrusting the pipes during the rectification of coal-tar. It also occurs in a native state associated with certain coals and lignites. It is a hydro-carbon, consisting of 60 carbon and 40 hydrogen; has a peculiar aromatic

odour; is extremely volatile, fusing at 180°; burns with much smoke; and dissolves in alcohol and ether.

Natatores, Natatorial (Lat. *nato*, I swim).—In ornithology, the swimming or natatorial order of birds, readily distinguished by their oar-like, webbed, or partially-webbed feet. The order includes the ducks, gulls, pelicans, divers, and penguins.

Naticidae.—Sea-snails; a family of carnivorous gasteropods, named from the genus *natica*, which has been taken as the type of the family. The *Naticidae* occur fossil in all formations from the Silurian upwards; the existing genera are also widely distributed. The naticæ frequent sandy and gravelly bottoms, ranging from low-water to 90 fathoms.

Native.—A term largely employed in mineralogy to designate any mineral or metallic substance which occurs in nature in a state of absolute purity, or all but absolute purity. We have thus *native alum* and *native sulphur*, in contradistinction to those prepared artificially; and *native gold* and *native copper* occurring in the pure metallic state and not in that of ores. Most of the substances termed "native" are generally more or less contaminated with extraneous impurities.

Natrolite.—Prismatic zeolite or mesotype, occurring in many varieties of trap-rock, either in veins, drusy cavities, or disseminated. Derives its name from the amount of soda it contains. According to Thomson, a specimen from Antrim consisted of 48 silica, 25 alumina, 16 soda, 10 water, and traces of potash, lime, and iron peroxide.

Natron (*natrium*, an early chemical term for sodium).—Natron is a native carbonate of soda, occurring in solution in the waters of many springs and salt lakes (Egypt); as a crystalline crust on the beds of dried-up lakes, in deserted river-courses, and on numerous *salinas* or upheaved sea-reaches (South America); as a pulverulent efflorescence on the ground, as in the plain of Debrecsin in Hungary; and as a product of decomposition in many lavas, traps, and other volcanic rocks. Natron is extensively employed in the arts and in agriculture, and large quantities are annually imported from various regions.

Naumannite (after Dr Naumann, the Saxon mineralogist).—Selenide of silver, occurring in cubical crystals, and also massive, in thin plates and granular; of an iron-black colour, and metallic lustre. Consists of 26.8 selenium, and 73.2 silver.

Nautilidae.—A well-known family of tetrabranch cephalopods, of which the *nautilus* has been taken as the type. It includes the genera *nautilus*, *lituites*, *trochoceras*, and *clymenia*, which see. Of the existing nautilus there are only three or four species found in Indian seas, while the fossil species exceed 100. "In the recent nautilus," remarks Dr Buckland, "the shell is smooth, but in many fossil species it is arranged like the patent iron-roofing, so remarkable for its strength and lightness."—See CEPHALOPODA, and tabulations, "ANIMAL SCHEME."

Nautilites.—A general term for fossil shells apparently allied to the existing nautilus. They are found in all formations from the Silurian upwards, but are now represented by three or four species only. They are distinguished from the ammonites by their central siphuncle, simple sutures, and fewer whorls.

Nautiloid (*nautilus*, and *eidos*, likeness).—Literally "nautilus-like;" a term usually applied to the many-chambered shells, or rather cell-cases,

of those foraminifera whose coils present externally a remarkable resemblance to those of the pearly nautilus.

Navicula (Lat., a little boat).—A genus of Diatoms or microscopic plant-growths, so called from their siliceous boat-like cases, which are perforated by six transverse slits, and in many species exquisitely ornamented. They are free floaters, and seem to move by ciliary action; abound in existing waters, as well as in many Post-tertiary and Tertiary strata.

Neanderthal.—A portion of the valley of the Düssel near Düsseldorf, and celebrated since 1857 for its ossiferous cavern, and the peculiarly shaped human cranium discovered therein by Dr Fuhlrott. The cave occurs in the precipitous southern or left side of the winding ravine, about sixty feet above the stream, and a hundred feet below the top of the cliff. The cranium whose conformation has given rise to much speculation is of unusual size and thickness, with a very low and narrow forehead, and enormously developed supra-orbital ridges—so much so that in this latter respect it somewhat resembles the skull of the gorilla. Anatomists are now agreed that the skull is either abnormal, or belongs to an early and extinct European race. The cranium, along with other bones of the same skeleton, were found in the cave-mud, which is five feet thick, but uncovered by any crust of stalagmite.

Nebular Theory (Lat. *nebula*, thin filmy clouds).—A theory or hypothesis often referred to in speculative geology. In the primal condition of the solar system, it is supposed that the sun was the centre or nucleus of a *nebulousity* or *luminous mass*, which revolved on its axis, and extended far beyond the orbit of the most distant of the planets—these bodies then having no existence. The temperature gradually diminishing, and the nebula contracting by refrigeration, the rotation increased in rapidity, and zones of nebulousity were successively thrown off in consequence of the centrifugal force overpowering the central attraction. These zones, being condensed, and partaking of the primary rotation, constituted the planets, some of which in turn threw off zones which now form their satellites. In this way the formation of the Solar group is accounted for—a view which the nebulists attempt to support by certain appearances in space (*nebulae* and *nebulous clusters*) which present themselves to the telescope of the astronomer.

Nérolite (Gr. *nekros*, dead, and *lithos*, stone).—A term applied to certain nodules in limestone strata, such as those of Baltimore, U.S., which when struck exhale a fetid odour, like that of putrid flesh. Concentrated nodules of fetid limestone or *stinkstein*, which see.

Necronite.—A variety of orthoclase, which when struck gives off a fetid odour.

Needles.—A familiar term in geography and geology for pointed, detached masses of rock standing out from the cliffs or shores to which they geologically belong, and from which they have been severed by the erosive action of the tides and waves, as the "Needles" off the Isle of Wight. Applied also to the pointed summits of mountains, the *aiguille* or needle-top of the French, which see.

Needle-Stone.—A name given by the older mineralogists to acicular varieties of *natrolite*, *scolécite*, &c. Needle-spar, *arragonite*; Needle-ore, *aikenite*; &c.

Nemacanthus (Gr. *nemo*, I scatter, and *akantha*, spine).—A genus of

Oolitic ichthyodolulites or ray-spines, so called from their being covered with minute denticles or prickles, and supposed to belong to the ostraciont fish *CERATODUS*, which see.

Neocomian.—A term of D'Orbigny's for the Greensand or Lower Cretaceous formation, which is specially developed in the vicinity of Neufchatel (Neocomum). The term is now very generally used by English and American geologists, some of whom (considering the intimate relation of the Lower Greensand and Wealden fossils) arrange the Wealden as "Lower Neocomian."—See tabulations, "GEOLOGICAL SCHEME."

Néogene (Gr. *neos*, new, and *ginomai*, I am formed).—The Pliocene and Miocene Tertiaries are grouped together by some Continental geologists under the term Néogene (*new-born*), in contradistinction to the decidedly older strata of the Eocene.

Neolite (Gr. *neos*, new, *lithos*, stone).—A massive or rather laminar-massive variety of talc, in which portion of the silica is replaced by alumina, and to which a blackish-green colour is imparted by the presence of protoxide of iron, so named by Scheerer from the belief of its being newly formed by the infiltration of waters which have passed over rocks containing magnesia.

Neozoic (Gr. *neos*, new, and *zoe*, life).—Arranging the fossiliferous strata into two great categories—the *Palæozoic* and *Neozoic*—the former includes all up to the close of the Permian, the latter all from the commencement of the Trias up to the existing order of things. It thus embraces the Mesozoic and Cainozoic of some palæontologists. The term was proposed by the late Edward Forbes on the ground that, while there was a wide difference between Palæozoic and Mesozoic fossils, there was really no essential difference between Mesozoic and Cainozoic, and that therefore it would be more philosophical to divide the whole lapse of geological time into two great epochs only—viz., the *Palæozoic* and *Neozoic*.—See tabulations, "GEOLOGICAL SCHEME."

Népheline (Gr. *nephelē*, a cloud).—A double silicate of alumina and soda, occurring in small crystals in the igneous rocks (imbedded or in druses), and so termed from its transparent fragments becoming *cloudy* in nitric acid. Closely related to or identical with *elsolite*—the nephelines being more or less transparent, of vitreous lustre, and colourless or white, whereas the *elsolites* are more opaque, of resinous lustre, and generally of reddish-brown hues. Nepheline is also less fusible than *elsolite*. Being found in ejected blocks on Monte Somma, Vesuvius, it is sometimes known as *Sommeite*.

Néphrite (Gr. *nephros*, a kidney).—A technical term for the tough silico-magnesian mineral better known as *Jade*, which see. Formerly little plates of it were suspended from the neck as a charm in the case of *nephritic* or kidney complaints; hence the name.

Neptūnian (*Neptunus*, god of the sea).—Applied to stratified rocks, or to those deposited in and by the agency of water (aqueous), in contradistinction to *Plutonic* or igneous.

Nereites.—Long, sinuous, annulated tracks and impressions occurring on Silurian and other strata, and from their numerous segments and circ-rhated or tentacled feet, apparently allied to the existing *Nereidæ* or Sea-centipedes. The living family includes some elongated and distinctly annulated worms, which possess a well-developed head, furnished with tentacles and eyes, and a mouth with a proboscis which is sometimes

unarmed, and sometimes furnished with three or four feet. The cirri or tentacles attached to the feet are often of considerable length, and in some species are even annulated. Many of the fossil impressions present analogous characters, hence their presumed affinities to annelids of the Dorsibranchiate order (*Errantia*); but in others the characters are not so obvious, and it has been suggested by M. Geinitz that not a few of the so-called *Nereites* may be soft and fleshy forms of Graptolithina.

Nereogräpus.—A term applied by M. Geinitz to many of the Silurian organisms known as *Nereites*, from the belief that they were soft-stemmed creatures like the graptolites, and not annelids resembling the existing *nereis*.

Ness, Naes, or Nase (literally *nose*).—In geography, any promontory or sudden projection of the land into the sea; as Dungeness, Fifeness, the "Naze," &c.

Neuróptera (Gr. *neuron*, nerve, and *pteron*, wing).—Literally "nerve-wings;" an order of insects characterised by the finely reticulated nervures of their membranous wings, of which there are two pairs; as the Dragonfly, the Phryganea, &c. Several fossil species have been found in the Oolitic strata of England and Germany, and these seem referable to the family *Libellulidae* or Dragonflies.—See INSECTA.

Neurópteris (Gr. *neuron*, nerve, and *ptéris*, fern).—An extensive, but indifferently defined, genus of fossil ferns occurring abundantly in the Coal-measures, and also, but in less profusion, in the Permian, Trias, and Oolite. In *neuropteris* the leaves are usually bi-pinnate; leaflets more or less pointed at the apex, somewhat cordate at the base, and attached by the middle portion only, have no midrib but what is produced by the union of the nervures or veins, that proceed from the axis of the leaflet in branching well-marked lines to the margin, which is entire in the Coal-measure and Permian species, but occasionally slightly serrated in those of the Oolite. The genus takes its name from the curved dichotomous veins of its leaflets; many of the species were of gigantic habits; and in several the pinnated divisions were furnished with a small circular leaflet, which, when detached, is apt to be mistaken for a cyclopteris.

New Red.—A brief expression for the New Red Sandstones (Permian and Triassic) which occur above the Coal-measures, in contradistinction to the Old Red, which lies below.

New Red Sandstone.—Immediately above the Coal-measures—in some instances lying unconformably on and in others insensibly graduating from them—occurs a set of red sandstones and pebbly conglomerates, yellowish magnesian limestones, and variegated shales and marls, enclosing irregular masses of rock-salt and gypsum. To this series of strata, as more especially developed in England, the earlier geologists applied the term *New Red Sandstone*, in contradistinction to the *Old Red Sandstone* system which lies beneath the Carboniferous formation. More recently it has been proposed to divide these new red sandstones, magnesian limestones, and saliferous marls into two distinct systems, the *Permian* and the *Triassic*—the former embracing the lower members, which are largely and typically developed in the government of Perm, in Russia; and the latter comprising the upper members, known as the "Trias," or triple group, in Germany. The reasons for this new arrangement are, that the fossils of the magnesian limestone and lower red sandstones seem more closely allied to those of the Coal-measures beneath, than to those of the varie-

gated sandstones and saliferous marls above,—in other words, present a *Palaeozoic* aspect; while those of the upper sandstones and marls are decidedly *Mesozoic*. To render this new arrangement more intelligible, let us suppose all the red sandstones, marls, and magnesian limestones hitherto known in England as “The New Red Sandstone,” to be present in one section. We should then have, reposing unconformably on the Coal-measures, the following series of strata:—

MESOZOIC, or TRIASSIC.	4. Series of coloured marls.	Purple-coloured marls below the Lias. Alternations of red and bluish-white marls, with layers and nodules of gypsum. Thin layers of argillo-calcareous stone. Red and bluish marls, with gypsum and beds of rock-salt.
	3. Variegated red and white sandstone.	Red and white sandstone, mostly fine-grained, and often impregnated with salt. Red conglomerate, full of pebbles of older rocks.
PALÆOZOIC, or PERMIAN.	2. Magnesian limestone.	Red and white marls. Thin-bedded compact limestone, with very little magnesia, and few organic remains. Red and white marls and gypsum. White, yellow, or reddish magnesian limestone in thick beds, crystallised, compact, or earthy, often full of sparry cavities, and containing marine organic remains. Marl slate in thin layers, occasionally enclosing fishes.
	1. Yellow or purple sand and sandstone, and marl.	An extremely variable series of sandstones, sands, and clays of various colours, irregular thickness, and much local diversity of character. Plants like those of the Coal-measures.

From the preceding tabulation, the reader will perceive at a glance the nature of the strata formerly designated the New Red Sandstone, as well as the limits of the Permian and Triassic systems into which it is now divided, and which are still occasionally spoken of as the *Lower* and *Upper New Red Sandstones*.

Nickel (Ger).—One of the metals; white, ductile, malleable, attracted by the magnet, and, like iron, capable of being rendered magnetic. Its specific gravity, when hammered, is about 9. It is rather more fusible than pure iron; is not altered by exposure to the air and moisture at ordinary temperatures, but is slowly oxidised at a red heat. It is found in all meteoric iron; but its principal ore is a copper-coloured mineral found in Germany, and called *nickeline* or *kupfer-nickel*—“nickel” being a term of detraction used by the miners, who expected from the colour of the ore that it would contain copper. Since the manufacture of German silver or *argentane*, nickel has, however, become an object of considerable importance, and is extracted from several ores, as from *Gersdorffite* or nickel-glance, *Nickeline* or copper-nickel, and the like. These are usually compounds (*specie*) of nickel, cobalt, antimony, arsenic, sulphur, or iron, and belong to the family PYRITES. The salts of nickel are mostly of a grass-green colour, and the ammoniacal solution of its oxide is deep blue, like that of copper.

Nickel-Glance.—Known also as *Geradorfite*, a greyish-white, massive and granular ore of nickel, occurring in the transition rocks of upper Germany, Sweden, Spain, Brazil, and other countries, and consisting, on the average, of 35.5 nickel, 45.2 arsenic, and 19.3 sulphur—part of the nickel being replaced by iron or cobalt.

Nickeline.—The *kupfer-nickel* or copper-nickel of Werner, and the *arsenical nickel* of other authors. One of the chief ores of nickel, occurring in strings and nodules, but generally massive and disseminated in veins (rarely in beds), in the granitic and crystalline rocks, and also in Secondary strata associated with cobalt, silver, and copper. It is found abundantly in Germany, and to some amount in America, Cornwall, and other countries. It consists of 44 nickel and 54 arsenic (part of the latter being often replaced by antimony), with traces of sulphur, iron, cobalt, and lead. Family PYRITES.

Nickel-Ochre, Nickel-Green.—An arsenate of nickel occurring massive, earthy, friable, and in short capillary crystals of an apple-green colour, whence the familiar name. Consists of nickel, 37.6; arsenic acid, 33.4; and water, 24.

Nidulites (Lat. *nidus*, a nest).—Undetermined organisms occurring in Silurian strata, and so named because at first supposed to be the *nidi* or egg-masses of a gasteropod, similar to those of the modern *natica*. "This explanation," says Mr Salter, "fails, however, when the organism is more closely examined; since the cells are equal and regular on both sides of a central lamina, and are set back to back like the cells of a honeycomb." They seem more akin to the Bryozoa (*retepora* and *flustra*); but differ in their great size and in the absence of any plate or cover to the cells.

Nilsonia (after Nilson).—One of Brongniart's genera of Cycadaceous leaves, occurring in the Lias and Oolite; but now ranked as a species of *Pterophyllum*, which see.

Nipadites.—A genus of fossil palm-nuts found by Mr Bowerbank in the Tertiary clays of the island of Sheppey, near London; and so called from their resemblance to the fruit of the existing *Nipa fruticans* of Bengal and the East India Islands. The *Nipa* is allied to the cocoa-nut tribe on the one side, and on the other to the *Pandanus* or screw-pine. It is a low-growing plant, luxuriating in marshy tracts at the mouths of great rivers, particularly where the waters are brackish. And Mr Bowerbank remarks, that "if the habits of the plants to which the fossil fruits belonged were similar to those of the recent *Nipa*, it will account for their abundance in the London Clay in the Isle of Sheppey; which formation, from the great variety of stems and branches, mixed up with star-fishes, shells of molluscs, and bones of fishes, crustaceans, and reptiles of numerous marine and fresh-water genera, is strikingly characteristic of the delta of a river, which probably flowed from near the equator towards the spot where these interesting relics are deposited."

Nitre (Gr. *nitron*).—The familiar as well as technical term for the *nitrate of potash*—46.6 potash and 53.4 nitric acid. Known also as *salt-petre* and *prismatic nitre-salt*. "It is," says Brande, 'Dict. of Science,' "spontaneously generated in the soil, and crystallises upon its surface in several parts of the world, especially in India, whence nearly the whole of the nitre used in Britain is derived. It has occasionally been produced artificially in *nitre beds*, formed of a mixture of calcareous soil and animal matter. In these nitrate of lime is slowly formed, which is extracted by

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lixiviation, and carbonate of potash added to the solution, which by double decomposition gives rise to the formation of nitrate of potash and carbonate of lime: the latter is precipitated; the former remains in solution, and is obtained in crystals by evaporation. Nitre crystallises in six-sided prisms; is soluble in seven parts of cold water, and in less than its weight of boiling water. It has a cooling taste, and is anhydrous. At 616° it fuses, and at a red heat is decomposed." It is used in glass-making, in medicine, as an antiseptic, for producing nitric acid, but especially, and most extensively, in the manufacture of gunpowder.

Nitratine.—The mineralogical term for the *nitrate of soda*—36.6 soda and 63.4 nitric acid. Known also as *cubic nitre* or *rhombohedral nitre-salt*, from its crystallising in rhombic crystals. "This salt," says Nicol ('Man of Mineral'), "occurs in the district of Tarapaca on the northern frontier of Chili, where it forms beds averaging four feet thick, and extending forty leagues in length. It rests on marl containing fragments of shells in a basin-like pampa, and is mixed with various salts. It is supposed to have been left by the sea, but the chemical nature of the salt is against this opinion." It is largely used as a manure, and is employed in the arts as a substitute for nitre, but is unfitted for manufacturing gunpowder from its deliquescent in the air.—See **SALINAS**.

Nitrocalcite (*nitron*, and *calx*, lime).—Nitrate of lime, occurring in pulverulent efflorescences on old walls and in limestone caves, especially near decaying animal matter. Has a greyish-white colour; sharp bitter taste; readily soluble in water; and consists of 32.00 lime, 57.54 nitric acid, and 10.56 water.

Nitrogen (Gr. *nitron*, and *ginomai*, I produce).—One of the elementary gases; so called from its being a constituent or generator of nitre. It is a colourless, inodorous, and tasteless gas, not absorbed by water, and has no action on vegetable colours. It extinguishes all burning bodies, is itself unflammable, and, being unrespirable, is destructive of life; hence the earlier term *azote* (*a priv.*, and *zoe*, life). It is somewhat lighter than atmospheric air, and combines with oxygen in five proportions, forming *nitrous oxide* (NO), *nitric oxide* (NO^2), *hyponitrous acid* (NO^3), *nitrous acid* (NO^4), and *nitric acid* (NO^5). Nitrogen is an important element in nature. It constitutes four-fifths, or 79 per cent, of the volume of atmospheric air; it enters largely into the composition of many plants and animals, and forms their chief nutritive principle; is present in the native nitrates of soda and potash; occurs in coal and a few other minerals, evidently of organic origin; and is given off by certain springs and volcanic vents.

Nitromagnesite.—Nitrate of magnesia; a saline efflorescence occurring in the same places with nitrocalcite or nitrate of lime, which it closely resembles in character, but consists of 24 magnesia, 65 nitric acid, and 11 water.

Noble.—A term frequently employed in mineralogy to express excellence or the highest degree of purity, as *noble opal*, the precious opal; *noble hornblende*, pargasite; *noble tourmaline*, the finest transparent varieties of that mineral.

Noble Metals.—The name given to those metals which can be separated from oxygen by heat alone. They are gold, silver, platinum, rhodium, iridium, osmium, and mercury.

Nodes (Lat. *nodus*, a knot).—In astronomy, the points where the

orbit of a planet cuts the plane of the ecliptic; or generally the points where the orbit of one planet cuts or crosses the orbit of another. In botany, the thickened part of a stem or branch from which a leaf is developed.

Nodosaria (Lat. *nodosus*, knotted, full of knots).—A genus of foraminiferal organisms occurring in Chalk, Tertiary, and Recent formations; and so termed from the arrangement of their cells, which are somewhat elongated and placed end to end, forming a minute, knotty, or bead-like frustule—the last cell having a round central opening.

Nodule (Lat. *nodus*, a knot).—Any irregular concretion of rock-matter collected by attraction or aggregation round some central nucleus, as nodules of ironstone, flint, &c. *Nodular* concretions may be aggregated around either organic or inorganic nuclei.

Noeggerathia.—A genus of palm-like leaves found in the Carboniferous and Permian systems; so named after Dr Noeggerath, who has done much for the elucidation of our fossil floras. In *Noeggerathia* the leaves are petiolated, pinnated; the leaflets nearly cuneiform, applied against the edges of the petiole, toothed towards the apex, and furnished with fine diverging veins.

Nomadic (Gr. *nomadikos*).—Pastoral; wandering; applied in geography and ethnography to those tribes that subsist by the tending of herds and flocks, and consequently wander hither and thither in search of new pastures, like the Tartars of Central and Northern Asia. Used in contradistinction to settled and civilised as subsisting by agriculture and dwelling in towns and villages.

Nonionina.—A genus of nautiloid foraminiferous organisms occurring in the Chalk, in Tertiary strata, and in the existing seas. Their simple cells are arranged like the chambers of the nautilus, the last having a single narrow aperture.

Normal (Lat. *norma*, a rule).—According to rule or law; obeying what is believed to be the natural law; occurring in the ordinary course of nature.

Northern Drift.—A synonyme of the "Glacial Drift" or "Erratic Boulder Group," because in the northern parts of Europe and America the materials seem to have been brought by polar currents from the *northern* to the *southern* regions.—See GLACIAL DRIFT.

Notidanus (Gr. *notos*, ridge, and *idanos*, beautiful).—A genus of fossil shark-teeth, each tooth having the crown or ridge composed of a series of sharp angular enamelled points, the first of which is the largest, and is notched on the anterior edge. The base of the tooth is bony, flat, and furnished with a longitudinal groove beneath the edge of the enamel. They are found in the Oolite and Chalk, but are specifically most abundant in the Lower Tertiaries.

Notite.—A variety of Palagonite (which see) from the Val di Noto in Sicily, whence the name.

Notopocorystes (Gr. *notos*, the back, carapace).—A genus of cretaceous crabs, whose carapaces (the only portions yet definitely known) appear to have some relations with the existing genus *Corystes*. The corystes have elongated oval carapaces; have the tail folded under the body when at rest; have the first pair of their ten limbs chelate, the others terminating in a slender claw; and are furnished with two pairs of antennæ—the outer being long and setaceous.

Notornis (Gr. *notos*, the south, and *ornis*, bird).—Literally "southern bird;" a short-winged rail or coot first known by its sub-fossil bones found in the sands and volcanic debris of New Zealand, and believed to be extinct; but subsequently one or two living specimens have been obtained.

Nototherium (Gr. *notos*, the south, and *therion*, beast).—An extinct genus of gigantic quadrupeds found in the alluvial or Upper Tertiary deposits of Australia. As far as the teeth, jaws, and other scattered bones enable the comparative anatomist to decide, the *Nototherium* manifests pachydermal modifications of the marsupial type; hence the inference that Australia (whose largest native quadruped is now the kangaroo) was, immediately preceding the current era, inhabited by a marsupial vegetable-feeder as large as the rhinoceros.

Novaculite (Lat. *novacula*, a razor).—A mineralogical term for *whetstone*, in allusion to the principal purpose to which it is applied. Whetstones of sufficiently fine texture, and keen siliceous grain, are found among the clay-slates and mica-schists of most metamorphic districts.

Nucleolites (*nucleus*, a little nut or kernel, and *lithos*).—A genus of sea-urchins belonging to the family *Clypeidae*, and characterised by their oblong inflated shell, which is rounded in front and flat behind. The pores are united by grooves; the mouth is sub-central; and the vent in a deep furrow on the superior face. Several species occur in the Oolite, Chalk, and Greensand; one is known in Tertiary strata; and a recent species inhabits the seas of Australia.

Nucleus (Lat. *nux*, a nut—*nucleus*, a little nut or kernel).—The solid centre of any nodule or rounded mass is said to be its nucleus; the central matter round which any mass is collected or aggregated.

Núcula (Lat., a little nut).—An extensive genus of bivalves belonging to the family *Arcaæ*, and characterised by their trigonal inflated shells, with their umbones turned towards the short *posterior* side; the valves smooth or sculptured; margins crenulated; hinge with prominent internal cartilage pit, and a series of sharp teeth on each side. Living in many seas on coarse bottoms from 5 to 100 fathoms; and fossil from the Lower Silurian upwards. The species having the shell oblong and rounded in front, with the posterior side produced into a long beak, have been erected into the separate genus *Leda*.

Nugget (Sax.).—The usual name among gold-diggers for those irregular pellets of the metal which occur in auriferous drifts, and which are found of all sizes, from that of a pea to lumps many pounds in weight.

Nullah.—A Hindostanee term for those streams, or rather stream-courses, which are mountain torrents during the rainy season, and during the rest of the year are dry gravelly channels, with here and there a trickling of water.—See **WADI**.

Nummulina, Nummulites, Númmulite (Lat. *nummus*, a coin, and *lithos*, stone).—An extensive class of fossil foraminiferous organisms, so called from their general resemblance to a coin or piece of money. They occur in inconceivable numbers in certain rocks (the nummulitic limestone), and are of all sizes, from a mere point to discs an inch and half in diameter—being thus the largest organisms of their class. Perfect specimens appear as a calcareous solid circular body of a lenticular shape; smooth and slightly convex on both sides, and without any visible structure. On splitting the fossil transversely, or rubbing down one of the convex planes,

a series of minute cells, arranged in discoidal spire, is brought into view ; and these cells, in the living organism, were all connected internally, as well as communicated externally, by minute pores or *foramina* for the free passage of the *sarcode* or fleshy substance of the protozoan. The nummulite would appear to be a strictly Tertiary form, being unknown alike in Secondary or in recent deposits. It seems also to be an Old World form, its representative in time and in geological function in the New World being the genus *ORBITOIDES*, which see.

Nummulitic Limestone.—An important member of the Lower Tertiaries (Middle Eocene) of the Old World, and so termed from the number and variety of nummulites with which it is charged. "The nummulitic formation," says Lyell, "with its characteristic fossils, plays a far more conspicuous part than any other Tertiary group in the solid framework of the earth's crust, whether in Europe, Asia, or Africa. It often attains a thickness of many thousand feet, and extends from the Alps to the Carpathians, and is in full force in the north of Africa—as, for example, in Algeria and Morocco. It has also been traced from Egypt, where it was largely quarried of old for the building of the pyramids, into Asia Minor, and across Persia by Bagdad to the mouth of the Indus. It occurs not only in Cutch, but in the mountain-ranges which separate Scinde from Persia, and which form the passes leading to Caboul ; and it has been followed still further eastward into India, as far as Eastern Bengal and the frontiers of China." More recently it has been traced onward even to the Philippine Islands, thus forming a zone that girdles nearly one half the globe. As the *Nummulitic Limestone* seems characteristic of the Old World, so the *Orbitoidal Limestone* seems characteristic of the New—mountain-masses full 300 feet in thickness, and almost wholly made up of *Orbitoides*, occurring near Suggsville in North America, and apparently on the same, or nearly the same, geological horizon.

Nuthétes.—Abbreviated from the Greek *Nouthetetes*, monitor, in reference to the affinities of the fossil to the northern lizards so called. A carnivorous or insectivorous lizard from the Purbeck beds of the Upper Oolite, of the size of the great land-monitor of India, and furnished with serrated teeth for piercing, cutting, and lacerating its prey.

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Oasis (Gr.)—In physical geography, a green and fertile spot in a desert ; originally applied by Herodotus to the inhabited patches of fertile ground which occur around springs in the Libyan desert. The word is said to be of Coptic origin, signifying "inhabited."

Oase, Ooze.—The name usually given to the soft slimy mud that covers extensive areas of the deeper sea-bed. Speaking of this mud, Captain Dayman, in his 'Deep-Sea Soundings,' says, "Between the 15th and 45th degree of west longitude, lies the deepest part of the ocean, between Ireland and Newfoundland, varying from about 1500 to 2400 fathoms, the

bottom of which is almost wholly composed of the same kind of soft mealy substance, which for want of a better name I have called *Oaze*. This substance is remarkably sticky, having been found to adhere to the sounding-rod and line through its passage from the bottom to the surface, in some instances from a depth of more than 2000 fathoms." On microscopic examination this oaze was found to consist for the most part of foraminiferal organisms, there being about 90 per cent of calcareous, and only 10 per cent of siliceous matter; the mass when dried greatly resembling chalk in colour and consistency.

Oblate (Lat. *oblatus*).—Generally applied to spherical bodies more or less flattened at opposite sides or poles; shaped like an orange. The earth is an *oblate* spheroid, being flattened at either pole to the extent of about thirteen miles, and thus deviating from the true spherical or globular figure.

Obolus (a small Greek coin).—A genus of bivalves belonging to the Lingula family, and characterised by their orbicular, smooth, calcareo-corneous, sub-equivalve shells, which have the hinge margin somewhat thickened inside, and the lower valve with a notch for the pedicle. There are several species occurring in the Silurians of Northern Europe; hence the "obolite grit" of Sweden and Russia.

Obsidian (Gr. *opsianos*, so called, it is said, from being used by the ancients for looking-glasses; others derive it from *Obsidius*, a Roman, who first brought it from Ethiopia).—A glassy lava almost undistinguishable from artificial glass-slag, and placed by mineralogists under the Felspar family. Its composition is variable, but it consists in general of about 80 silica, 10 alumina, with varying minor percentages of potash, soda, lime, and oxide of iron. It is a true volcanic glass, of various colours, but usually black or blackish-grey; occasionally porphyritic from enclosed crystals of glassy felspar; has a specific gravity of about 2.37; is hard enough to scratch glass; and nearly opaque. It occurs in streams or in detached masses near many volcanoes; and has been used by rude nations for the fabrication of mirrors, axes, knives, arrow-heads, and the like. As might be anticipated from its origin, obsidian frequently graduates into *pumice* and *pearlstone*, which see.

Occidental Diamond.—An occasional lapidary's term for limpid and colourless varieties of rock-crystal when cut and polished. Used in contradistinction to the Oriental or true diamond.

Occipital (Lat. *occiput*, the hinder part of the head).—Belonging to the back part of the head; hence we speak of "occipital bones," "occipital parietes," &c.

Ocean (Gr. and Lat.).—In geography, the vast body of water which covers about three-fourths of the surface of the globe, and which, in connection, composition, and other characteristics, forms one continuous "world of waters." For convenience of description, and relatively to the land, it is usual to subdivide it into the Atlantic, Pacific, Indian, Arctic, and Antarctic Oceans, each of which from its position and configuration is characterised by different kinds of waves, tides, and currents; by differences in composition, temperature, and depth; and as a consequence by different facies of animal and vegetable life. The minor ramifications of the ocean into land are known as seas, bays, gulfs, creeks, inlets, and the like, according to their forms and dimensions.

Océanic.—Belonging to, occurring in, or produced by, the ocean; hence

we speak of "oceanic life," "oceanic currents," "oceanic deltas," and the like.

Ocellária (Lat. *ocellus*, a little eye).—A conical-shaped zoophyte occurring in chalk-flints, and so named by Kœnig from the numerous eye-like polyp-cells which stud its surface.

Ochre (Gr. and Lat. *ochra*).—A term familiarly applied to a well-known pigment, varying in colour from a pale yellow to a deep orange or brown, and consisting of iron peroxide and water, with varying proportions of clay in a state of impalpable subdivision. Strictly speaking, *ochre* is a hydrated peroxide of iron, consisting of about 80 of the peroxide and 20 water; but is very rarely found absolutely pure, and appears to be a product of decomposition. It occurs in all formations, much of that used in Britain being obtained from beds in the Coal formation. In mineralogy, the term *ochre* is also applied to other products of decomposition resulting from the oxidised ores, as *cobalt-ochre*, *bismuth-ochre*, *antimony-ochre*, *uran-ochre*, *chrom-ochre*, &c., most of them occurring as earthy masses or pulverulent incrustations.—See REDDLE.

Octahédrite, Octahédrite.—A mineralogical term for the pure oxide of titanium, which occurs in elongated eight-sided crystals, in veins in the primary and crystalline rocks. Known also as *Anatase* and *Pyramidal Titanium ore*.

Octahédral, Octahedral (*octo*, eight, and *hedra*, side).—Having eight equal sides, as octahedral oxide of titanium, octahedral iron ore, &c.,—these ores occurring in eight-sided crystals.

Oculina (Lat. *oculus*, the eye).—A genus of stony branching corals, belonging to the family of Madrepores, and so called from the eye-like or star-like polyp-cells which stud its smooth, thick, short branches. The common *Oculina virginea* is often known as "white coral," in contradistinction to the *Corallium rubrum*, or "red coral" of commerce.

Oculus.—A not unfrequent term of the older mineralogists for minerals having an opalescent or eye-like lustre; as *oculus mundi*, hydrophane; *oculus piscis*, ichthyophthalmite or fisheye-stone, &c.

Odontaspis (Gr. *odous*, tooth, and *aspis*, buckler).—Literally "buckler-tooth;" a genus of shark-like fishes occurring in the Chalk formation, and so termed from the buckler-like aspect of their teeth—the only portions yet known.

Odontolite (Gr. *odous* and *lithos*).—Literally "tooth-stone" or bone turquois, which consists of teeth or bone impregnated and coloured by oxide of copper.—See TURQUOIS.

Odontology (Gr. *odous*, tooth, and *logos*, discourse).—That branch of anatomical science which treats of the teeth. "The term 'tooth,'" says Professor Owen, "has been applied in zoology and zoönomy to various organs and parts; usually to such as are so solid, so shaped, and so situated, as to serve for seizing and operating on the food; but it has been also applied to parts, such as the prominences on the hinge of bivalve shells, which have no relation to the digestive functions. The siliceous spines of infusorial animalcules, the calcareous jaws of sea-urchins, the chitinous hooks and hooklets of sea-worms, and many corresponding parts of invertebrate animals, are described as 'teeth;' but odontology proper exclusively relates to those bodies, hardened chiefly by the phosphate of lime, which are attached to parts of the mouth or beginning of the alimentary canal, and which are peculiar to the vertebrate classes of animals.

. . . True calcified teeth vary in their tissue and composition, and still more in regard to number, size, form, structure, position, and mode of attachment, in different animals. They are principally adapted for seizing, tearing, dividing, pounding, or grinding the food; in some they are modified, to serve as weapons of offence and defence; in others, as aids to locomotion, means of anchorage, instruments for uprooting or cutting down trees, or for transport and working of building materials. They are characteristic of age and sex; and in man they have secondary relations to beauty and to speech. Teeth are always most intimately related to the food and habits of the animal, and are therefore highly interesting to the physiologist. They form, for the same reason, most important guides to the naturalist in the classification of animals; and their value as zoological characters is enhanced by the facility with which, from their position, they can be examined in living or recent animals; whilst the durability of their tissues renders them not less available to the palæontologist, in the determination of the nature and affinities of extinct species, of whose organisation they are often the sole remains discoverable in the deposits of former periods of the earth's history."—See Owen's 'Odontography,' and article 'Odontology' in 'Encyclopædia Britannica.'

Odontopteris (Gr. *odous*, *odontos*, tooth, and *ptēris*, fern).—A somewhat obscure genus of fossil ferns occurring in the Coal-measures, and so called from the blunt tooth-like lobes of their leaflets. In *Odontopteris* the leaves are bi-pinnated; leaflets lobed, membranous, adhering by all their base to the rachis, and furnished with a very indistinct midrib, from which a few ill-defined branching or simple veins pass into the lobes, which have no midrib.

Odour, as a characteristic of minerals, is not possessed by any of them in a dry unchanged state; but it may be obtained from several by moistening with the breath, by friction, by heat, or by the action of an acid. Hence we have the *argillaceous odour*, or the odour of moistened clay, when certain rocks, as chlorite and serpentine, are breathed upon; the *fetid*, or the odour of sulphuretted hydrogen, obtained from certain limestones when rubbed or struck with the hammer; the *sulphurous*, obtained by friction from pyrites, or by heat from most of the sulphurets; and the *garlic odour*, obtained by friction from some, and by heat from most, of the arsenical salts and ores.

Eningen Beds.—A remarkable lacustrine deposit of highly fossiliferous marls and limestones, occupying a hollow in the molasse near Eningen, where the Rhine issues from the Lake of Constance. They are of Upper Tertiary age, and are replete with remains of dicotyledonous plants, freshwater shells, crustaceans, insects, fishes, and turtles, and have also yielded remains of quadrupeds.

Offing.—In maritime phraseology and geography, that part of the sea which lies outward or *off* at some distance from a shore or harbour; hence vessels are said to ride or lie at anchor in the offing, that is, beyond the shoals and other influences of the shallower shore.

Ogygia (from *Ogyges*).—A genus of Silurian trilobites, so named in allusion to the obscure and remote character of these Crustaceans, or from their being found in the lowest or earliest fossiliferous formations.

Ogygian.—From *Ogyges*, one of the earliest of the Grecian monarchs. His origin, the age in which he lived, and the duration of his reign, are so obscure, that the term *Ogygian* is often applied to everything of dark or

OIL — OLD

doubtful origin or antiquity. Chronologers date his reign at some two thousand years (1761) before the Christian era. **Ogygian Deluge.**—The name given to a great inundation mentioned in fabulous history, and supposed to have taken place during the reign of Ogyges of Attica.

Oil-Coals.—A commercial designation gradually coming into use for those varieties of coal (chiefly cannels) which yield a large proportion of oil on distillation. Many of these slaty cannels pass insensibly into shales—"oil-shales"—and it is not always easy to draw the line of demarcation between an oil-shale and oil-coal. The poorer varieties yield from 25 to 40 gallons of crude oil per ton, the richer from 50 to 80, and even some picked samples so much as 100 gallons per ton.

Oil- Wells, Oil-Springs.—The common designation, especially in America, for discharges, whether natural or artificial, of petroleum or rock-oil. Since the introduction of paraffin and paraffin-oil, the oil-wells of the United States and Western Canada have assumed a vast commercial importance, hundreds of thousands of barrels being raised annually and rectified either for home use or for exportation to Europe.—See PETROLEUM.

Oldhamia.—A peculiar sertularian-like zoophyte, or perhaps polyzoon, occurring in the lowest Silurian or Cambrian rocks, and so termed because first detected by Professor Oldham in the purplish hard schists of Bray Head, near Dublin. In Oldhamia the cells occur in radiating tufts or bundles alternately arranged on a common axis or stem.

Old Men's Workings.—"In mining," says Ansted, "this term is used in reference to mines that have been formerly worked, and where underground excavations are found on reopening the mine. By the *old men*, miners mean any former workers of mines they are engaged in."

Old Red.—A brief expression for Old Red Sandstone, in contradistinction to New Red—the former lying beneath, and the latter above the true Coal-measures. As a system of fossiliferous strata, the Old Red Sandstone is now generally treated under the term DEVONIAN.

Old Red Sandstone, or Devonian System.—Taking the Coal-measures as a sort of middle formation, there is generally found in the British Islands one set of reddish sandstones lying beneath, and another set lying immediately above them. By the earlier geologists the lower set was designated the *Old Red Sandstone*, and the upper the *New Red Sandstone*; and though the progress of the science has rendered it necessary to impose certain limitations on these terms, they are still sufficiently distinctive and easily remembered. The Old Red Sandstone may therefore be held as embracing the whole series of strata which lies between the Silurian system on the one hand, and the Carboniferous system on the other. Certain portions of the system are peculiarly developed in Devonshire, and contain a copious and varied fossil fauna; hence the introduction by Murchison and Sedgwick of the term *Devonian*—a term now generally employed as synonymous with the earlier and more descriptive one of "Old Red Sandstone." Characterised on its lower margin by strata containing the remains of fishes, and which form a line of separation, as it were, between it and the underlying Silurian, and defined, on its upper margin, by the rarity of that vegetation which enters so profusely into the composition of the Carboniferous rocks, there can, in general, be no difficulty in determining the limits of the Old Red formation. On the whole, its composition is manifestly arenaceous, the great bulk of the system consisting, as the name implies, of a succession of sandstones, alternating with subordinate layers of sandy shale and beds of

concretionary limestone. The sandstones pass in fineness from close-grained fissile flags to thick beds of coarse conglomerate, and the shales from sandy laminated clay to soft flaky sandstone. The whole system is less or more coloured by the peroxide of iron—the shades varying from a dull rusty grey to a bright red, and from red to a fawn or cream-coloured yellow. The “Devonian” proper, on the other hand, exhibits in its middle and upper portions an abundant development of fossiliferous limestones and calcareous shales, of slaty shales or dark bituminous-looking schists. Indeed, north of the Bristol Channel, the fossiliferous limestones, schists, and grits of Devonshire are altogether wanting, and the term “Old Red Sandstone” then becomes the more appropriate designation for the system. In the north of Europe a similar preponderance of arenaceous members prevails; while, on the Rhine and in Belgium, the fossiliferous limestones of Devon have their parallels in equally fossiliferous calcareous strata. Throwing the system into three great groups, as is usually done, we are presented with the subjoined co-ordinations:—

UPPER	{ Baggy Point sandstone and Morte Bay schists, N. Devon; goniatite limestone, Belgium; yellow sandstones of Dura Den, Fife, with <i>holoptychii</i> and <i>pterichthys</i> ; Telerpeton beds, Lossiemouth (Triassic?); <i>Cyclopteris</i> beds of Kilkenny; red and white sandstones of Dunse.
MIDDLE	{ Ilfracombe and Plymouth limestones, Devon, and Eifel limestone, Belgium, both abounding in corals, crinoids, shells, trilobites, and occasional fishes. Red sandstones of Berwick and Roxburgh; red sandstones, marls, conglomerates, and cornstones of Hereford, Cumberland, Fife, Perth, and Forfar, —the characteristic fossils being <i>holoptychii</i> , <i>bothriolepis</i> , &c.
LOWER	{ Caithness flags and shales, abounding in fishes— <i>dipterus</i> , <i>osteolepis</i> , <i>coccosteus</i> , <i>cheiracanthus</i> , &c.; N. Foreland, Porlock, and Torquay beds, Devon; <i>Spirifer</i> sandstones and shale, Rhine. Great pebbly conglomerates and flagstones of Forfar, with <i>cephalaspis</i> , <i>acanthodes</i> , and <i>ptyergotus</i> ; Ludlow and Lanark tilestones, with <i>ptyergotus</i> , <i>eurypterus</i> , and other kindred crustaceans.

Palæontologically, though yielding numerous plant-impressions and remains of corals, crinoids, shell-fish, trilobites, and *eurypterites*, the most marked and characteristic fossils of the system are, perhaps, its numerous and varied FISHES—often of peculiar forms, and covered with bony plates (*coccosteus*, *pterichthys*, *cephalaspis*, &c.), clad with hard enamelled, and variously ornamented scales (*holoptychius*, *dipterus*, *asterolepis*, &c.), and not unfrequently armed with sharp, defensive fin-spines (*cheiracanthus*, *diplacanthus*, &c.).—See tabulations, “GEOLOGICAL SCHEME.”

Oligiste, **Oligistic** (Gr. *oligistos*, least, signifying that it is less rich in metal than magnetite).—A name frequently given to specular iron ore, or those varieties of hæmatite which have a crystalline structure.

Oligocene (Gr. *oligos*, small, and *kainos*, recent).—A term employed by M. Beyrich to designate certain Tertiary beds of Germany (Mayence, &c.), which appear to be neither exactly of Eocene nor of Miocene age, but to occupy an intermediate position.—*Oligocene*, a little more recent than Eocene—*slightly recent*.

Oligoclase (Gr. *oligos*, small, and *klasis*, fracture).—A mineralogical term for soda-felspar, in allusion to its peculiar fracture, as distinguished

from *orthoclase* or potash felspar. According to Berzelius, it consists of 68.70 silica, 23.95 alumina, 8.11 soda, 1.20 potash, and 2.05 lime, with traces of magnesia and iron. It occurs in granites and porphyries; is of a white or whitish-grey colour, and melts easier than *orthoclase* or *albite* to a clear glass.—See FELSPAR.

Olivinite.—Hydrated arseniate of copper, occurring in prismatic crystals, and also in reniform, granular, and fibrous crusts, and generally of a deep olive green, whence the name.

Olivine.—An olive-coloured semi-transparent mineral, occurring in rounded grains and crystals in many basalts and lavas. It is common in the basaltic greenstones of Scotland, and consists of about 40 silica, 48 magnesia, 11 iron protoxide, with traces of manganese and alumina. Fine green-coloured transparent crystallised varieties are known as *Crysolite*, and occasionally used as gems, though not much valued, on account of their softness and frequent flaws.

Ombria (Gr. *ombrios*, rain).—An early, but now disused, term for fossil sea-urchins (*echinites*, *cidarites*, *galerites*, &c.), which were supposed to have fallen from heaven in showers.

Onchus (Gr. *onchos*, bent or hooked like a talon or arrow-barb).—According to Agassiz, a genus of Cestracionts found in the Silurian, Devonian, and Carboniferous formations. Their fin-spines or dorsal rays only are known, and of these seven or eight species are enumerated. They are wide at the base, and bent backwards, with their posterior margin destitute of teeth.

Onyx.—The general term for those varieties of agate which consist of alternate layers of white, brown, or black, and which were greatly valued by the ancients for cameos. The word is Greek, and signifies *nail*, in allusion to the parallel bands of the mineral resembling those frequently seen on the human nail. High prices are often given for genuine antique onyx cameos.

Oolite (Gr. *oon*, an egg, and *lithos*, stone).—A variety of limestone, so termed from its being composed of small rounded grains, resembling the eggs or roe of a fish—each grain having usually some minute fragment of sand as a nucleus, around which concentric layers of calcareous matter have accumulated. When the grains are very distinct and well-rounded, the term *roestone* is sometimes used as a synonyme; and when they are large and pea-like, the rock is known as *pisolite* or pea-stone (*pinum*, a pea). The marked occurrence of these oolites or roestones in certain of the Secondary strata of England, has given the name not only to the OOLITE FORMATION, properly so called, but also to the OOLITIC SYSTEM as now extended by modern geologists, which see.

Oolithes (Gr. *oon*, egg, and *lithos*, stone).—A general term for the fossil eggs of birds, reptiles, and oviparous animals—those of birds having been found in recent and Upper Tertiary formations (*Æpiornis*), and those of reptiles in Tertiary, and even, as recently supposed, in Oolitic strata (*Oolithes Bathonica*). The supposed egg-packets, or spawn of crustaceans, *Parka decipiens*, occur abundantly at the very base of the Old Red Sandstone; and that of mollusca (*Nidulites*) so early as the Silurian system.

Oolitic or Jurassic System.—Deriving its name from the prevalence of limestones of an *oolitic texture* as developed in England, or from the *Jura range*, as typically exhibited on the continent of Europe. This system

OOL

may be said to comprehend the whole of those peculiar limestones, calcareous sandstones, marls, shales, and clays which lie between the New Red Sandstone beneath and the Chalk formation above. And however similar these strata may be in some features, there is no truth in geology more fully established than this, that where the system is complete, the argillaceous laminated limestone and shales termed the *Lias* constitute the lowest group; the yellowish granular limestones, calcareous sandstones, sands and clays, called *Oolite*, the middle group; and the greyish laminated clays, with subordinate layers of limestone and flaggy ferruginous sandstones, the *Wealden* or upper group. Taking these groups in descending order, the following synopsis exhibits their subdivisions as typically developed over extensive areas in England:—

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|---------|---|
| WEALDEN | <p>{ WEALD CLAY.—Greyish or bluish laminated clays imbedding concretions of ironstone, thin layers of argillaceous limestone, and sandy ferruginous flags.</p> <p>{ HASTINGS SANDS.—Sands and sandstones frequently ferruginous, with partings of clay; beds of clay and sandy shale more or less calcareous, with subordinate beds of limestone.</p> |
| OOLITE | <p>{ PURBECK BEDS.—Estuary limestones alternating with sands and clays (formerly grouped with the Wealden).</p> <p>{ UPPER OOLITE.—Coarse and fine grained oolitic limestones, with layers of calcareous sand and concretions (<i>Portland stone</i> and <i>Shotover sand</i>); dark laminated clays, with gypsum and bituminous shale (<i>Kimmeridge clay</i>).</p> <p>{ MIDDLE OOLITE.—Coarse-grained, shelly, and coralline oolite, with calcareous sands and grit (<i>Coral rag</i>); dark-blue clays, with subordinate clayey limestones and bituminous shale (<i>Oxford clay</i>); shelly calcareous grit (<i>Kelloway rock</i>), with subjacent blue clays.</p> <p>{ LOWER OOLITE.—Coarse, rubbly, and shelly limestones (<i>Cornbrash</i>); laminated shelly limestones and grits (<i>Forest marble</i>); sandy layers and thick-bedded blue clay (<i>Bradford clay</i>); thick-bedded oolite, more or less compact and sandy (<i>Bath or great oolite</i>); flaggy grits and oolites (<i>Stonesfield slate</i>); marls and clays with soft marly limestone (<i>Fuller's earth</i>); calcareous freestone, irregularly oolitic, and yellow sand (<i>Inferior oolite</i>).</p> |
| LIAS | <p>{ UPPER LIAS.—Thick beds of dark bituminous shale; beds of pyritous clay and alum shale; indurated marls or marlstone.</p> <p>{ LOWER LIAS.—Dark laminated limestones and clays; bands of ironstone; layers of jet and lignite; beds of calcareous sandstone.</p> |

All the members are well developed in England; it is chiefly the Lias and Oolite that are found in France, Switzerland, and Germany; patches of the Lias and Oolite occur in Scotland; the Oolite alone in Hindustan and North America; and beds of Wealden epoch have been detected in Hanover and Westphalia. As deposits, the Lias and Oolite are eminently marine, though occasionally exhibiting evidence of alternate elevation and depression; while the Wealden and Purbeck beds display frequent alternations of marine with fresh-water or estuary conditions.

With the exception of the higher mammalia, almost every existing order

is represented in the fauna of the Oolite, but the forms are all Mesozoic, and died out at the close of the Chalk era. The vegetation of the system is also extremely varied, but the highest orders appear to be coniferous, and as yet no example of a true exogenous timber tree has been detected. Of its numerous fossils the most characteristic are the *cycadaceæ*, of which the stems, fruits, and leaves are found in abundance; the shells of the *gryphææ*, so peculiarly plentiful in the Lias; the *ammonites* and *belemnites* of innumerable species; the *insects* of the Lias and Weald; the *pterodactyle* or flying-lizard; the fresh-water and marine *turtles*; and, above all, the *ichthyosaurus*, *pleriosaurus*, and other sauroid reptiles, whose marvellous forms and variety have suggested for the Oolite the not inappropriate title of "the age of reptiles." Still higher in the scale of being than these are the warm-blooded marsupial mammals, *amphitherium*, *phasciotherium*, *spalacotherium*, *stereognathus*, *triconodon*, and *plagiaulax*—the earliest of their kind yet detected in the crust of the earth. For further details see LIAS and WEALDEN; and for foreign and contemporary equivalents see tabulations, "GEOLOGICAL SCHEME."

Opal (origin unknown, but supposed to be connected with the Greek words *opa*, *opos*, signifying vision).—The *quarz resinite* of Häüy; the *uncleavable quartz* of Mohs; and in its pure state a *hydrate of silica*, consisting of from 90 to 95 of silica, and from 5 to 10 of water. In most of its varieties there is some admixture of alumina, lime, and iron; hence, as a mixed siliceous mineral, it is allied to agate and chalcedony, but distinguished by its peculiar vitreous or rather resinous lustre. It occurs colourless or of all colours; is amorphous; in the compact varieties has a conchoidal fracture, but in others is splintery, or even earthy. The better-known varieties are, 1. *Precious* or *noble opal*, which owes its beautiful play of colours to a multiplicity of minute pores in the mass; 2. *Hydrophane*, or those sub-varieties of noble opal which, when immersed in water, become transparent by the filling up of the pores; 3. *Sun* or *fire opal*, or *girasol*, transparent, of a brilliant vitreous lustre, and generally of a bright hyacinth red or yellow when held between the eye and the light; 4. *Hyalite*, *glassy opal*, or *Müller's glass*, occurring in transparent, very glassy, small mammillary incrustations; 5. *Common opal*, semi-transparent, vitreous, and of various colours; 6. *Semi-opal*, duller and less pellucid than common opal, and often of variegated colour; 7. *Cacholong*, or *mother-of-pearl opal*, having a pearly resinous lustre, and so called from its being found near the river Cach in Bucharia; 8. *Wood opal*, or wood converted into opal by siliceous infiltration, but still retaining its woody texture; 9. *Jasper opal*, or such ferruginous varieties as pass imperceptibly into common variegated jasper; and, 10. *Menilite* or *liver opal*, a compact semi-resinous variety found at Mont Menil, near Paris, and usually of a dark brown or liver colour. Besides the above there are other kinds enumerated by lapidaries, but these are for the most part founded upon very minute and unimportant distinctions.—See each variety under its own designation.

Opalescent.—Resembling opal in lustre; exhibiting a play of colours like some varieties of opal; displaying iridescence.

Opalised.—Converted into a substance resembling opal; converted into opal by the infiltration of silica in a state of solution (natural gelatine of silica). Hence "opalised wood," or wood petrified by silica, and acquiring a structure resembling opal.

Open Cast.—In mining, the method of working a vein when the ore

appears at the outcrop, and can be obtained by workings open to the day, and without sinking a shaft.

Opérculum (Lat., a lid).—In conchology, the calcareous or horny lid with which gasteropodous molluscs (like the periwinkle) close the aperture of their shells when they withdraw within them for shelter. By some conchologists (Adanson, Gray, &c.), the operculum is considered as the equivalent of the right valve of the *Conchifera* or bivalves; but however similar in appearance, its anatomical relations are held by others to be altogether different. Opercular-like organisms are frequently found fossil.—In ichthyology, the gill-cover or bony flap which covers and protects the gills in fishes. Opercular bones are frequently found detached in "bone beds" and other fossiliferous strata.—In botany, the membranous lid which covers the *theca* or spore-case in mosses.

Ophidian (Gr. *ophis*, a serpent).—A serpent; belonging to the serpent order—the *Ophidia* constituting one of the main orders of Reptiles in Cuvier's arrangement. The ophidia are characterised by their numerous procoelal vertebrae, with a single transverse process on each side; have no sacrum, and no visible limbs. Remains of the order do not occur in strata of older date than the Tertiary.

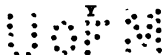
Ophite, Ophiolite (Gr. *ophis*, a serpent, and *lithos*).—Mineralogical terms for serpentine, but seldom used by British geologists.—See SERPENTINE.

Oracanthus (Gr. *oraios*, beautiful, and *akantha*, spine).—A genus of cestracion fin-spines, or ichthyodorulites, occurring in the Carboniferous formation, and so termed from the varied ornamentation of the species.

Orbiculina (Lat. *orbicula*, a little orb).—A genus of minute foraminiferous chambered shells, so called from their flattened globular form. Species of the genus are still living in tropical seas, and others are found fossil in the oldest Tertiaries.

Orbit (Lat. *orbis*, a track or path).—The course or path of a planet round the sun; generally, the course or path described by any of the heavenly bodies. The term is derived from the Latin word *orbis*, a globe or circle; hence the heavenly bodies are spoken of as *orbs*, and their courses as *orbits*, though, strictly speaking, their form is merely *spheroidal*, and their courses *elliptical*.

Ores (Ger. *erz*).—Metals occurring in nature in a state of purity are said to be *native*; when combined with other substances, so as to require various processes for their separation, they are termed *ores*; e.g., the sulphurets and carbonates of copper, in contradistinction from the pure ductile metal. Geologically, these ores may be found in veins, in indeterminate masses, or in regular strata; and the associated mineral matter is known as the *matrix*, *gangue*, *vein-stone*, or *ore-stone* of the metal. Ores of one or other of the metals occur in all formations, but most abundantly and availably in districts that have been subjected to subterranean disturbance and metamorphic agency. The idea that certain metals are peculiar to certain geological epochs, or rather that they occur in certain rock-formations more abundantly than in others, is one that derives support more from the disturbing and metamorphic agencies to which these formations have been subjected, than from any chronological succession or development of the metals themselves. The metals are the same in all times: their ores only appear in different states in different formations, and segregated or collected more abundantly in some localities than in others. It is usual to describe the



metallic ores as occurring in the four following conditions:—1. In a metallic state, and either solitary or combined with each other—in the latter case forming “alloys.” 2. Combined with sulphur, forming sulphides or sulphurets. 3. Combined with oxygen, forming oxides. 4. Combined with acids, forming carbonates, phosphates, &c., which generally go by the name of “metallic salts.”

Organic (Gr. *organon*, a member or instrument).—Applied to plants and animals, as being supplied with certain organs or instruments for the purposes of growth and nutrition. Their structure is said to be *organic*, and they are termed *organised* bodies, in contradistinction to minerals, which are *inorganic*, and whose increase takes place by external additions, and not through the instrumentality of any peculiar organs. The term **Organic Remains** is used as synonymous with *fossils*, and applies to all remains of plants or animals found imbedded in the crust of the earth.

Oriental.—A term in very frequent use by lapidaries and jewellers, and applied to gems as a mark of excellence, because originally the finest and purest varieties were brought from the East. Thus they speak of “Oriental opal,” “Oriental ruby,” “Oriental sapphire,” and the like, whether these stones come from the East or not.

Ornithichnites (Gr. *ornis*, *ornithos*, a bird, and *ichnon*, a footprint).—Footsteps, supposed to be those of birds, and found abundantly on the sandstone slabs of the Trias, especially on the sandstones of the Connecticut valley in North America. Many of these are of gigantic size, and would seem to indicate the existence of cursorial and grallatorial birds three or four times the size of the existing ostrich. Professor Hitchcock has been the great elaborator of the Connecticut footprints, and considers many of them as undoubtedly those of birds; but Professor Owen, while admitting the close resemblance, administers the following necessary caution:—“Footprints alone, like those termed ‘Ornithichnites,’ are insufficient to support the inference of the possession of the highly developed organisation of a bird of flight by the creatures which left them. The Rhynchosaur and biped Pterodactyles already warn us how closely the ornithic type may be approached without the essential characters of the saurian being lost. By the Chirotherian ichnolites we learn how closely an animal, in all probability a Batrachian, may resemble a pedimanous mammal in the form of its footprints.” On the other hand, the marked tridactylous form of the footprints, the texture of the epidermal impressions, and the amount of uric acid contained in the coprolites usually associated with them, afford pretty strong presumptive evidence of their really being the footsteps of birds.

Ornithocópros (Gr. *ornis*, *ornithos*, a bird, and *kopros*, dung).—Literally “bird-excrement;” a term occasionally applied to guano, which is, in the main, composed of the droppings of countless seafowl, and some accumulations of which are semi-mineralised, and evidently of vast antiquity.

Ornithodóphia (Gr. *ornis*, *ornithos*, bird, and *adelphos*, brother).—Literally “allied to the birds;” an ordinal term occasionally applied to the Ornithorhynchus and Echidna, which, in their toothless jaws, in the conformation of their sternum and scapula, and especially in the structure of their reproductive organs, exhibit unmistakable signs of divergence towards the class of Birds.

Ornithoidichnites (Gr. *ornis*, *ornithos*, a bird; *eidos*, resemblance; and *ichnon*, a footprint).—Literally “bird-like footprints;” a term denoting

resemblance merely, without affirming, as "ornithichnites" does, that they are really the footmarks of birds.

Ornitholites (Gr. *ornis*, a bird, and *lithos*, stone).—The general term for the remains of birds occurring in a fossil state. From the absence of teeth in birds, and the close approximation of the form in many genera, it is often all but impossible to determine the relations of the *ornitholites* that occasionally turn up to the paleontologist. As yet they have been found only in the newer formations—the Oolite, Chalk, and Tertiaries.

Orodus (Gr. *oraios*, beautiful, and *odus*, tooth).—A genus of cestracient or palatal fish-teeth occurring in the Carboniferous system, and so termed from the beauty of their varied specific forms.

Orography, Orology (Gr. *oros*, a mountain).—The science which describes or treats of the mountains and mountain-systems of the globe—that is, of the profiles or elevations of the earth's surface.

Orpiment (an abbreviated corruption of the Latin word *auripigmentum*, or golden pigment).—Yellow sulphuret of arsenic, consisting, according to Klaproth, of 62 arsenic and 38 sulphur. It is found in metalliferous veins, and imbedded in various formations, and occurs in foliated masses, in concretions, or in minute crystals. The foliated structure of orpiment, and its arsenical odour when exposed to heat, distinguish it from native sulphur. *Red orpiment* is the name frequently given to the bisulphuret of arsenic or **REALGAR**, which see.

Orthis (Gr. *orthos*, straight).—A genus of fossil bivalves, known only in Palæozoic strata, and taken as the type of the family *Orthida*. They are characterised—shell transversely oblong, radiately striated, valves slightly convex, beak inconspicuous, hinge-line narrower than the shell, rarely foraminated. In the Silurian sub-genus *Ortholina* the shell is impunctate, widest at the hinge-line, and generally perforated by a small round foramen.

Orthite (Gr. *orthos*, straight).—A silico-aluminate of cerium, so called by Berzelius from its occurring in straight needle-shaped or columnar masses in the granites of Scandinavia. It is closely related to, if not identical with, the *Allanite* and *Cerin* of other mineralogists.

Orthocanthus (Gr. *orthos*, straight, and *akantha*, spine).—A genus of straight cylindrical fin-spines occurring in the Carboniferous formation, and belonging to some unknown cestracient. They have hitherto been found detached, and unassociated with any teeth or scales that could lead to their true systematic character.

Orthoceras, Orthoceratite (Gr. *orthos*, straight, and *keras*, horn).—A genus of straight tapering chambered shells, so called from their tapering to a point like a horn. They occur from the Silurian to the Trias inclusive—many of their fragments indicating a length of more than six feet.

Orthoceratidae (Gr. *orthos*, straight, and *keras*, a horn).—A family of fossil cephalopodous chambered shells, so called from their tapering horn-like shape—some being straight, others curved, and some discoidal. The family includes such generic forms as *orthoceras*, *gomphoceras*, *oncoceras*, *phragmoceras*, *cyrtoceras*, *gyroceras*, &c., all of which are peculiar to the older formations. In all, the shell was essentially external; had a small body-chamber, into which the animal partly withdrew; had a complicated and large siphuncle; and was less calcified than in the nautilus and ammonite.

Orthoclase (Gr. *orthos*, straight, and *klasis*, fracture).—A mineralogical term for potash-felspar, because of its straight flat fracture. Orthoclase is often known simply as *felspar* or *prismatic felspar*; and whether in its trans-

parent or translucent varieties termed *adularia*, in the less splendid varieties known as *common felspar*, or in the glassy potash-soda variety known as *sanadine* or "glassy felspar," is one of the most important constituents of the globe—occurring not only in granite, gneiss, and porphyry, but in many secondary formations composed of their debris, as in greywacke, and some sandstones and conglomerates. Orthoclase is very readily weathered and decomposed, and in this state falls down to the whitish earth or clay known as *kaolin*, and extensively used in the manufacture of porcelain and stoneware. *Compact felspar*, or *felstone* as it is sometimes termed, seems generally an admixture of orthoclase and quartz, and in this state, or in its softer and earthier condition of *claystone*, constitutes an important member of the Trap series.—See FELSPAR.

Orthónóta, Orthónótus (Gr. *orthos*, straight, and *notos*, the back).—A provisional sub-genus of *Modiola*-looking bivalves occurring in Paleozoic strata, and so termed from their long straight plaited backs. The subdivisions of these elongated modiola-like shells are by no means well established.

Orthóptera (Gr.)—Literally "straightwings;" an order of insects having the outer pair of wings straight and a little coriaceous, as the locust, grasshopper, and cockroach. The Orthoptera are known from the Oolite upwards.—See INSECTA.

Oryctology (Gr. *oryktos*, dug up, and *logos*).—Literally the "science of things dug up," that is, of all bodies, whether organic or inorganic, found buried in the earth. It was generally employed, however, as synonymous with Paleontology, and referred alone to fossils. It is now entirely disused.

Os, Osar.—A Swedish term for those elongated hillocks or mounds of gravel belonging to the Drift or Glacial period, and which are abundantly and characteristically scattered over Sweden and the islands of the Baltic. The greater part of the gravel of these hills, which occasionally rise to 100 or 200 feet, is of small dimensions, and mixed with much sand, and they almost always exhibit a slope and a scarped side; the former being towards the north, which is the source of the detritus. Same as the *kaims* of Scotland, and the *estirs* of Ireland, which see.

Oscula (Lat.)—Literally "little mouths;" the name given to the larger pores that occur on the surface of a sponge—these orifices being few compared with the ordinary pores, and frequently elevated in slight prominences. While the pores form the openings of the *incurrent*, the oscular form the openings of the *excurrent* canals, or circulatory system of the living mass.

Osse (Lat. *os*, a bone).—A technical term proposed by Dr Leidy of Philadelphia for the so-called *Sombrero Guano*, which see. The term has reference to the composition of the substance, which appears to be a compacted mass of altered bones—the remains of turtles and other marine vertebrata that had accumulated for ages on some sub-marine shoal that had subsequently been elevated above the sea-level into the position of the present little island of Sombrero, West Indies. Many reefs and shores of vast extent are known to have had their origin in the testaceous coverings of the lower animals, but Sombrero appears to be the first instance of an island formed of the remains of the higher animals.

Osmeroides (Lat. *osmerus*, the smelt).—A genus of fossil fishes found in the Chalk of England by Dr Mantell, and so named by Agassiz from their resemblance to the smelt. There are two or three species known to paleontologists.

Osmium (Gr. *osme*, odour).—A metal discovered by Tennant in crude platinum, and so named from the strong disagreeable odour given out by its oxide. Two native alloys of osmium and iridium are known to mineralogists under the name *osmiridium* and *iridosmium*, both of which are found in flattish grains or scales in the gold and platina sands of the Ural. Their composition is variable.

Osseous (Lat. *os*, a bone).—Bony; containing bone; resembling bone in texture or structure.

Osseous Breccia (Lat. *os*, a bone).—Bones and fragments of bones cemented together by calcareous or other matter, and found in caverns and fissures, are so termed. The "Bone breccias" of Gibraltar and other parts of the Mediterranean shores are well known to geologists; and accumulations of a similar nature, though containing the remains of very different animals, have been discovered in Australia. The Mediterranean breccias consist wholly of the bones of land animals, and of these comparatively few belonging to Carnivora; while the absence of marine remains and of the usual abrading effects of water, shows that the breccia was formed on dry land, and not beneath the sea. "The only rational explanation of these facts," says Dr Mantell, speaking of the Mediterranean bone breccias, "is that which assumes the original union of these distant rocks and islands into a continent or large island, which, like Calabria, was subject to repeated visitations of earthquakes; and that the animals which inhabited the country fell into the fissures thus produced, and were preserved by the calcareous infiltrations that were constantly in progress. Subsequent convulsions and denuding agencies severed the country into rocks and insular masses, of which catastrophes the osseous conglomerates are the physical and only records."

Ossicle (Lat. *ossiculum*, a little bone).—A small bone; applied in anatomy to various small bones of the skeleton; also to the calcareous or bony-like joints and segments of encrinites, star-fishes, and similar animals.

Ossiferous (Lat. *os*, a bone, and *fero*, I yield).—Containing or yielding bones or fragments of bones, as many of the Post-tertiary sands and gravels. Thus we have ossiferous gravels, ossiferous marls, ossiferous caverns, &c.

Ossiferous Caverns, Breccias, and Gravels.—Of more recent date than the newest Pliocene lignites, clays, and marls, there occur in many regions (the northern hemisphere especially) gravels replete with bones of terrestrial and marine mammals (*ossiferous gravels*); cemented and stalagmitic bone-breccias in caves and fissures (*osseous breccias*); and caverns in limestone ridges filled with bones imbedded in ochraceous mud or stalagmite (*ossiferous caverns*), some of these the skeletons of animals that had lived and died there, and others that had been dragged thither and devoured by carnivora, or had been drifted by waves and currents, while the sea and land stood at varying and variable levels. Though generally of more recent date than the true Tertiaries, many of these cave-deposits are of vast antiquity—their lower floors containing the remains of Pliocene or Post-pliocene genera; the middle deposits the remains of true Pleistocene species; while the upper layers of mud and stalagmite imbed the bones, charred wood, and rude stone-implements of the human race. Their epoch, therefore, as regards their organic remains, is partly Pleistocene and partly recent; and though the caves themselves were originally excavated by the waves of Pliocene seas, most of them have undergone exten-

sive changes alike during the Pleistocene and current eras. The most remarkable *ossiferous caverns* in England are Kirkdale Cave near Kirkby Moorside in Yorkshire, the Dream Cavern near Worksworth in Derbyshire, Banwell Cave in the Mendip Hills, Kent's Hole and Brixham Cave near Torquay, Oreston near Plymouth, Cefn near Denbigh, and Paviland near Swansea. In Germany the slopes of the Harz Mountains give us the caves of Baumann, Biel, and Schwazfeld; between the Harz and Franconia is the Bear Cavern of Glucksbrunn; the Jura formation near Baireuth is celebrated for the rich associated caverns of Gailenreuth, Wunderhole, Rabenstein, Kahloch, Zahnloch, Schneiderloch, &c. In Westphalia the same Oolitic formation has the caves of Kluterhole and Sandwich. The caves of Adelsberg in Carniola, and the Dragons' caves in Hungary, have also yielded bones. In France, instructed by Dr Buckland's researches, two caverns, rich in bones, have been described by M. Thirria, near Vesoul, and several others near Narbonne by Marcel de Serres, Tournai, Christol, &c., and one near Miremont by M. de la Nave. — *Ossous breccia* appears singularly connected with the coasts of the Mediterranean. It occurs at Gibraltar, in Languedoc, and at several other points in the south of France, at Antibes, Nice, Pisa, Cape Palinurus, north of Bastia in Corsica, Cagliari in Sardinia, Meridolce and Maccagnone in Sicily, in Dalmatia, &c. Ferruginous breccia, in which bones are associated with pisolitic iron-ore, occurs in Württemberg, and in Carniola in Jura limestone. Such are a few of the best known of these curious repositories in Europe, whose characteristic *Mammalian remains* may be briefly tabulated as follows:—

Pachyderms.—Elephas, Mastodon, Hippopotamus, Chæropotamus, Rhinoceros, Tapir, Sus, &c.

Solipeds.—Equus.

Ruminants.—Cervus, Antelope, Urus, Bos, Merycotherium, &c.

Carnivores.—Felis, Hyæna, and the peculiar hardened excrement, *album græcum*, of the hyæna, Machairodus, Ursus, Gulo, Wolf, Fox, Polecat, Weasel, Otter, &c.

Rodents.—Porcupine, Beaver, Arvicola, Rat, Lagomys, Hare, Rabbit, &c.

Edentates.—Megalonyx, Megatherium, Macrauchenia, Manis, &c.

Osteolepis (Gr. *osteon*, a bone, and *lepis*, scale).—Literally “bony scale;” a genus of ganoid fishes peculiar to the Old Red Sandstone, and so named from the enamelled bony character of its scales. There are three or four species catalogued by palæontologists; but in all the rhomboidal bony scales, the enamelled osseous plates of the head, and the thickly-set bony rays of the fins, are the distinguishing characteristics.

Osteology (Gr. *osteon*, a bone, and *logos*, discourse).—Literally “the science of bones;” a knowledge of the skeleton or bony fabric of the different tribes of animals; comparative anatomy. “The organs of every animal,” observes Cuvier, “must be regarded as forming a machine, the parts of which are mutually dependent on each other, and exquisitely adapted for the functions they have to perform; and such is the intimate relation of the several organs, that any variation in one part is constantly accompanied by a corresponding modification in another.” It is by a knowledge of this law that the palæontologist is enabled to reassemble, as it were, the scattered remains of the beings of a former state of the globe—to determine their place in the scale of animated nature, and to reason on their organisation, habits, and economy, with as much clearness and

certainly as if they were still living before him. Hence the ready determination of a Carnivorous cutting-tooth from an Herbivorous grinding one, and that again from the chisel-like tooth of a Rodent; so also of the articulation of the jaw that has to cut, the jaw that has to grind, and that which has to gnaw; the foot that has to seize, the foot that has to run, and the foot that has to burrow.

Ostracite.—A term occasionally applied to any fossil oyster or oyster-like shell whose species is undetermined.

Ostréidæ (Lat. *ostræa*, an oyster-shell).—The Oyster family, of which the common oyster is taken as the representative. The family is characterised by the shell being inequivalve, slightly inequilateral, free or adherent, resting on one valve; beak central, straight; ligament internal; epidermis thin; muscular impression single, behind the centre; and hinge usually toothless. The family is strictly marine, and includes the *oyster*, *anomia*, *placuna* or window-shell, the *pecten* or scallop, *lima*, the *spondylus* or thorny-oyster, and the *plicatula*. Of the living oyster there are about sixty species inhabiting tropical and temperate seas; while palæontologists enumerate about 200 fossil species occurring in strata from the Carboniferous Limestone upwards.

Otopteris (Gr. *ous*, *otos*, an ear, and *pterus*, fern).—A doubtful genus of fossil ferns occurring in the Coal-measures, New Red Sandstone, and Oolite, and so called in allusion to the auricle (or ear-shaped projection) with which the bases of their leaflets were furnished. According to Lindley, who erected the genus, *Otopteris* was probably a simply pinnated plant with a thickish petiole; had oblong obtuse leaflets attached to the petiole by the lower half of the base, the upper being free and auricled; the leaflets were without midrib, and furnished with veins which originated in the base, and curved right and left to the margins, only forking as they proceeded towards the extremity.

Otosóum (Gr. *otus*, a fabled pre-adamite giant, and *zoon*, an animal).—A provisional name given by Professor Hitchcock to certain unknown gigantic footmarks found in the New Red Sandstone of Connecticut. From their shape and other peculiarities they are supposed to be Batrachian (*sauroideichnites*).

Oudénodon (Gr. *oudes*, none, and *odous*, tooth).—A sub-genus of Dicynodont reptiles from the sandstone rocks of Rhénostorberg, South Africa; and so termed by Mr Bain, their discoverer, from their toothless jaws, which may possibly (after the analogy of the Narwale) be those of the females of tusk-bearing male dicynodonts.

Outcrop.—The edge of any inclined stratum when it comes to the surface of the ground is called its *outcrop*, *crop*, *basset*, or *basset-edge*. In mining language a stratum, when it comes to the surface, is said to "crop out;" and we also hear such phrases as its "coming to the day," "rising to the grass," and so forth—all expressive of its position as regards the surface.

Outliers.—In geology, portions of any stratified group which lie detached, or out from the main body, the intervening or connecting portion having been removed by denudation. Outliers may be identified with the main formations by the composition and alternations of their strata, and partly also by their fossils. In zoology and botany, groups or assemblages of species which "lie out from" or are separated from the main masses to which they are allied, and thus give evidence of changes of conditions over

the areas in which they occur. For example, a group of northern forms may now occur in a southern area—showing that this southern area has become warmer in the progress of geological change, and that the outlier of northern forms is good evidence of such a mutation.

Overlap.—A term frequently made use of by field-geologists, and employed to express that greater extension or spread of any set of superior strata by which they *overlap* or conceal the edges of those on which they rest. “While unconformability,” says Mr Jukes, “proves an elevation and denudation, and an absence of continuous deposition, overlap may take place in a perfectly continuous series, merely proving the fact of a depression of the area contemporaneously with that of the deposition of the overlapping strata.”

Oviferous, Ovigerous (Lat. *ovum*, an egg, *fero* and *gero*, I bear).—Egg-carrying; applied to certain animals (e.g., some spiders and crustaceans) that carry about with them their eggs after exclusion—being provided for that purpose with ovisacs, egg-packets, or other apparatus.

Oviparous (Lat. *ovum*, egg, and *pario*, I produce).—Literally “egg-producing,” as distinguished from *viviparous* or “young-producing.” Applied to birds, reptiles, fishes, &c., whose mode of generation is by the exclusion of a germ in the form and condition of an egg, the development of which takes place out of the body, either with or without incubation.

Ovisac (Lat. *ovum*, egg, and *saccus*, bag).—The egg-bag or membrane which invests or connects in one mass the eggs, spawn, or roe of crustacea, spiders, insects, shell-fish, and other allied creatures. Such *ovisacs* or *egg-packets* occur in a fossil state in ancient as well as in recent formations; e.g., *Parka decipiens* in the Lower Old Red, which is regarded by many as the ovisacs of *Pterygotti*.

Ovoviviparous (Lat. *ovum*, egg; *vivo*, I live; and *pario*, I produce).—Applied to animals whose mode of generation is by the exclusion of a living fœtus, more or less extricated from the egg-coverings, and which has been developed or hatched within the body of the parent as an *egg*—that is, without any placental attachment to the womb. The marsupials (kangaroo, &c.) among Mammals, the viper and salamander among Reptiles, the blenny and dog-fish among Fishes, the *paludina vivipara* and many bivalves among Molluscs, the scorpion and flesh-fly among Insects, the earth-worm and many of the intestinal worms, are examples of *Ovoviviparous* animals.

Ovulites (Lat. *ovum*, and *lithos*).—A general term for all fossil eggs, whether those of birds or of reptiles. Ovulites have been found in the stratified rocks from the Oolite upwards.—Same as **OOLITHES**, which see.

Oxalite.—Known also as *Humboldtine*; a native oxalate of iron occurring in yellowish capillary crystals, and occasionally in botryoidal and granular crusts, in the brown coal of Germany.

Oxford Clay.—The lower member of the Middle Oolite, so called from its being well developed in Oxfordshire and the midland counties of England. It consists of a bed of stiff, pale-blue, more or less calcareous clay (locally known as “clunch”), attaining in some places a thickness of from 200 to 500 feet, and abounding in ammonites and belemnites. It is capped by the “coral-rag,” and graduates below into the shelly concretionary limestone known as “Kelloway rock.”—See **OOLITE**.

Oxide.—Any substance combined with oxygen, without being in the state of an acid. **Oxidised.**—Converted into an acid by combination with

oxygen. **Oxidation**.—That process by which metals and other substances are converted into oxides.

Oxygen (Gr. *oxys*, acid, and *gennao*, I produce).—Literally “the acid-former;” so called from its property of forming acids when in combination with other elementary substances. It is one of the simple or elementary bodies, and one of the five that exist in a gaseous state. It was discovered by Priestly in 1774. As a permanent gas it is colourless; has neither taste nor smell; and is slightly heavier than common air, the proportion being as 11 to 10. It is sparingly absorbed by water, and is neither acid nor alkaline. It has a powerful attraction for most of the simple substances, forming with them *acids* and *oxides*—this *oxidation* being often rapid and attended with the evolution of heat and light (as in burning), and at other times slow, unattended with such phenomena (as in rusting of the metals). It is a most powerful supporter of combustion—the products of such combustion being sometimes *gaseous*, as carbonic acid, from the burning of charcoal; *liquid*, as water, from the burning of hydrogen; or *solid*, as oxide of iron, from the burning of that metal. As an element it is one of the most important and generally diffused in nature—forming one-fifth of the atmospheric air; one-third, by measure, of the gases that constitute water; and so generally does it combine with all metallic and non-metallic bodies, that it has been computed that about one-half of the ponderable matter of the crust of the earth is composed of oxygen gas. It plays also a most important part in the vital economy of the globe, being inspired by animals, who give out carbonic acid gas, while carbonic acid gas is absorbed by plants, which assimilate the carbon and set free the oxygen, again to be breathed by animals, and thus maintain the grand harmonies of nature.

Ozokerite, Ozocerite (Gr. *ozos*, odour, and *keros*, wax).—One of the mineral resins or rather fats; a soft semi-translucent waxy substance of a yellowish brown colour and pleasant aromatic odour, occurring in bituminous sandstones of the Coal formation. It melts at about 144° into a clear oily fluid; and is a pure hydro-carbon, consisting of 86 carbon and 14 hydrogen.

P

Pachycormus (Gr. *pachys*, thick, and *kormos*, body).—Literally “thick body;” a genus of sauroid fishes occurring in many specific forms in the Lias of England, and so named by Agassiz in allusion to their relatively robust bodies.

Pachydermata (Gr. *pachys*, thick, and *derma*, skin).—Thick-skinned mammalia; an order which includes the elephants, rhinoceroses, tapirs, &c., among living species, and the mastodon, palæotherium, &c., among extinct Tertiary races. The Pachyderms are perhaps the most prevalent forms in European Tertiaries, a region in which the pig is now their sole representative.—See tabulations, “ANIMAL SCHEME.”

Pachypteris (Gr. *pachys*, thick, and *pterus*, fern).—A genus of fossil ferns

chiefly from the Lower Oolite, and so named from their thick rigid leaflets. In *Pachypteris* the fronds are pinnate or bipinnate, the leaflets entire, without visible veins, having but a single midrib, and contracted at the base.

Pachyrhisodus (Gr. *pachys*, thick; *rhiza*, root; *odus*, tooth).—Literally "thick-root-tooth;" a genus of cycloid fishes founded by Agassiz on some remains from the Upper Chalk of England. The name has reference to the thickness of the base of the anchylosed teeth, which are bluntly conical; the scales are large, circular, and covered with minute asperities visible by the aid of a pocket lens.

Pachyspondylus (Gr. *pachys*, thick, and *spondylus*, vertebra).—The generic term applied by Professor Owen to certain large sauroid vertebræ collected by Dr Orpen in the Drakenberg Mountains of Southern Africa, and supposed to be of Triassic age.

Paco.—The Peruvian name for an earthy brown oxide of iron containing minute particles of native silver, or chloride of silver, disseminated through it. This *argentiferous gossan*, as it would be termed in Cornwall, is said to be the main source of the silver obtained by mining in Peru.

Pagoda-Stone.—The name given in China to a limestone containing orthoceratites, whose septa when cut and polished exhibit, in section, something like the tapering structure of a pagoda. Large and entire specimens of these orthoceratites are highly prized as ornaments; the belief being that they are engendered in the rock by the shadows of the pagodas that stand above.

Pagodite.—Same as *agalmatolite* or figure-stone; a species of steatite which the Chinese carve into ornamental figures and pagodas, whence the name. (*Poutghad*, house of a god or idol.)

Pagrus.—The hermit-crab; whose well-known habit of appropriating the deserted shells of whelks and other univalves for the protection of its defenceless abdomen has conferred on it the name. The remains of crabs of apparently similar characters and habits (*Merostylus*, &c.) are found in the Chalk and Tertiary formations.

Palaehinus, Palaehinidae (Gr. *palaaios*, ancient, and *echinos*, sea-urchin).—A genus and family of Palaeozoic sea-urchins or cidarites whose detached plates and long smooth spines occur abundantly in the shales of the Carboniferous Limestone. They differ from *Archaeocidaritis*, with which they are often associated, in their smooth spines and imperforate spiniferous tubercles—there being, as in the Echinus, no perforation for the ligament of the spine.

Palaedyptes.—Literally "ancient penguin;" a provisional term applied by Professor Huxley to some bird-remains from the Upper Tertiary (Pliocene?) beds of New Zealand, in consequence of their near approach, in configuration, to the bones of the crested penguin (*Eudyptes chrysolophus*). These remains indicate a bird fully double the size of any known penguin.

Palaocarabus (Gr. *palaaios*, ancient, *karabos*, lobster).—A provisional genus of macrurous or long-tailed crustaceans from the Lanarkshire Coal-field, and founded by Mr Salter on the cephalo-thorax, the only portion as yet discovered. This carapace is characterised by its oblong, quadrate, and convex form, inconspicuous mesial furrow, and punctate surface. Rostrum broad and deeply serrate; antennæ small; and antennules spiny and broadly expanded at the base.

PAL

Palæocetus (Gr. *palaios*, ancient; *ketos*, whale).—A provisional genus of fossil cetaceans founded by Mr Seelby of the Cambridge Museum on some vertebral remains from the Oxford or the Kimmeridge Clay. This Oolitic genus seems to stand as a connecting-link between the existing genera *Balaenoptera* and *Physalus*.

Palæocrangon.—Literally "ancient shrimp;" a Permian crustacean of the Zechstein or Magnesian limestone.—See PROSOPONISCUS.

Palæogeon (Gr. *palaios*, ancient; *gē*, the earth).—Belonging to the former conditions of the earth's surface as revealed by geology, as distinct from the existing terraqueous aspects as described by geography.

Palæolithic (Gr. *palaios*, and *lithos*, stone).—A term occasionally applied to the ancient or prehistoric *Stone Period*, which see.

Palæoniscus.—A well-known genus of ganoid fishes occurring in the Carboniferous and Permian formations. The species, which are numerous, are characterised by their moderate size, elegant heterocercal forms, highly enamelled rhomboidal scales, which in some species are crenulated or serrated on the posterior margins, rather small numerous-rayed fins supported by strong triangular fulcral scales, and jaws furnished with thickly-implanted brush-teeth. *Amblypterus* and *Eurynotus*, at one time associated with *Palæoniscus*, are now erected into separate genera.

Palæontology (Gr. *palaios*, ancient; *onta*, beings; and *logos*, reasoning).—Literally, reasoning about ancient beings; that science or subdivision of geology which devotes itself exclusively to a consideration of the plants and animals found fossil in the crust of the earth.

Palæoophis (Gr. *palaios*, ancient, and *ophis*, serpent).—Literally "ancient serpent;" a provisional genus of serpents whose vertebræ (in several specific forms) have been discovered in the Eocene Tertiaries of England. The remains of one specimen, from the Bracklesham beds, would indicate a length of about twenty feet, and from the compressed character of its caudal vertebræ, it is supposed to have been of aquatic habits—probably a sea-serpent.

Palæophytology (Gr. *palaios*, ancient, and *phyton*, a plant).—The science of fossil plants; one of the branches into which it has been proposed to divide the broader science of palæontology.

Palæosaurus (Gr. *palaios*, ancient, and *saurus*, lizard).—A generic term applied by Dr Riley and Mr Stutchbury to certain reptilian remains (of Thecodont type) discovered by them in the Permian strata, near Bristol. The term has reference to their great antiquity, compared with the reptiles of the Oolite and Weald.—See THECODONTOSAURUS.

Palæosiren (Gr. *palaios*, ancient).—A fossil reptile from the Lower Permian of Oelberg near Braunau, and so named by Dr Geinitz from its apparent affinities to the existing salamander—*Siren lacertina* of Linnæus.

Palæospalax (Gr. *palaios*, ancient, and *spalax*, mole).—Remains of the existing genus *Talpa* (mole) occur in the upper layers of bone-caves and the like; but the generic term *Palæospalax* has been applied to the remains of a closely-allied, if not identical animal, whose jaws and teeth have been found in a lacustrine deposit on the coast of Norfolk, associated with bones of elephant, deer, and beaver, and which must have been as large as a hedgehog.

Palæotherium (Gr. *palaios*, ancient, and *therion*, animal).—A pachydermatous mammal of the Eocene Tertiaries which seems to stand intermediate between the rhinoceros, horse, and tapir. About a dozen species

have been discovered, varying from the size of a horse to that of a hog; and the bones of the nose show that, like the tapir, they had a short fleshy semi-prehensile proboscis.

Palæoxylon (Gr. *palaïos*, ancient, and *xylos*, wood).—Literally "ancient wood;" a provisional genus erected by Brongniart for the reception of those coniferous-like stems found in the Coal-measures, and which are characterised by the presence of thick compound medullary rays—a character unknown in any living conifers. Several of the so-called *Pinites* and *Araucarites* belong to this genus.

Palæozoic, Palæozoic Formations (Gr. *palaïos*, ancient, and *zoe*, life).—Applied to the lowest division of stratified groups, as holding the earliest known forms of life, in contradistinction to the *Mesozoic* and *Cainozoic*. It includes the Cambrian, Silurian, Devonian, Carboniferous, and Permian systems of British geologists.—In treating of these formations, as developed in the Appalachian chain of North America, Professor H. Rogers has employed a nomenclature which requires explanation—and that explanation will be best given in his own words. "It was found," he says, "that these Appalachian Rocks were far from being sufficiently co-ordinate with the European Palæozoic strata, under their British types, to bear their names; while, on the other hand, the special titles assigned to them in New York were deemed too local and inexpressive, either of their position in the scale of formations, or of their ruling characters, to be usefully applicable. The fifteen formations, or series of deposits, defined by their prevalent organic remains, and by the physical horizons which separate them as sediments, extending from the lowest deposited in the dawn of animal life to those formed at the end of the Coal period, are called by names significant of their relative ages, the words employed suggesting metaphorically the different natural periods of the day. These names are—*Primal*, *Auroral*, *Matinal*, *Levant*, *Surgent*, *Scalent*, *Pre-meridian*, *Meridian*, *Post-meridian*, *Cadent*, *Vergent*, *Ponent*, *Vespertine*, *Umbral*, and *Seral*; meaning respectively the formations of the Dawn, Daybreak, Morning, Sunrise, Mounting Day, Climbing Day, Forenoon, Noon, Afternoon, Declining Day, Descending Day, Sunset, Evening, Dusk, and Nightfall. Some such nomenclature, based on time, is, for many reasons, preferable to the inexpressive ones which rest for the most part on geographical terms only locally correct, or on narrow and inconsistent palæontological characters."—See "PRELIMINARY TABULATIONS."

Palæozoölogy (Gr. *palaïos*, ancient, and *zoon*, an animal).—The science of fossil animals; one of the branches into which it has been proposed to divide the more general science of palæontology.

Palagonite (from Palagonia in Sicily).—A peculiar rock-product occurring in connection with modern volcanoes, and considered by Bunsen to have resulted from a chemical alteration of pyroxene rock. It is amorphous, of a yellowish-brown colour, glassy resinous lustre, easily broken, and about the hardness of calcareous spar. The *palagonite-tufa* of Iceland consists of 37.42 silica, 11.16 alumina, 14.7 iron peroxide, and 17.15 water, with minor proportions of lime, magnesia, and soda; and is partially soluble by the hot waters of the Geysers.

Palæpteryx (Gr. *palaïos*, ancient, and *apteryx*, wingless).—An extinct gigantic bird found fossil, or rather *sub-fossil*, in the ancient river-silts of New Zealand; and so termed from its close relationship to the existing *apteryx*, or wingless bird of these islands.

Páleryx.—A provisional genus of serpents from the Lower Tertiary strata of England, and so named from the apparent affinities of their detached vertebrae (the only relics yet found) to the living *Eryx*—one of the Boa and Python group of ophiidians.

Palichthyology (Gr. *palaíos*, ancient; *ichthys*, fish; and *logos*, reasoning).—That department of paleontology which treats of extinct or fossil fishes; e.g., the 'Palichthyologic Notes' of Sir Philip Egerton in various volumes of the 'Quarterly Journal of the Geological Society,'—the 'Poissons Fossiles' of Professor Agassiz, &c.

Palladium (Gr., from Pallas the goddess).—One of the metals, discovered in 1803 by Wollaston, and found in very small grains, of a steel-grey colour and fibrous structure, in auriferous and platiniferous sand. Its specific gravity varies from 11.3 to 11.8; and in fusibility it stands intermediate between gold and platinum. When native it is alloyed with a little platinum and iridium; is ductile as well as malleable; and is considerably harder than platinum. It is oxidised and dissolved by nitric acid, but its proper solvent is nitrohydrochloric acid. It forms alloys, most of which are brittle, with arsenic, iron, bismuth, lead, tin, copper, silver, platinum, and gold; the alloy with nickel is ductile.

Palmacites (Lat. *palma*, the palm-tree).—The general term for any fossil stem, leaf, fruit, or other organism which presents some analogy or resemblance to one or other of the existing palms. Restricted, however, for the most part to simple, cylindrical stems, covered by the bases of fallen petiolated leaves. Remains of palms occur in the Coal-measures and upwards; but more abundantly and unmistakably in the newer strata.

Paludina (Lat. *palus*, *paludis*, a marsh).—The 'marsh or river snail'; a common, turbinate, whorled, univalve, deriving its name from its prevalent habitat being marshes, ditches, or slow-running waters. About sixty species are distributed over the northern hemisphere, and nearly an equal number have been discovered from the Wealden upwards—the well-known Sussex or Petworth marble being almost wholly composed of the shells of *P. fluviatorum*.

Pámpas.—In physical geography, the vast treeless plains of the Paraguay and La Plata in South America, stretching from the eastern ridge of the Andes to the shores of Buenos Ayres, and thence southwards into the deserts of Patagonia. Though treeless, they are covered with luxuriant herbage—tall grasses and thistles—and are pastured by vast herds of wild cattle and horses.—See PAMPEAN FORMATION.

Pampean Formation.—The alluvial and comparatively recent deposits that overspread the Pampas of South America. "The Pampean formation," says Darwin, "is highly interesting from its vast extent (an area larger than that of France), its disputed origin (some ascribing its accumulation to debacles, others to the rivers of the country, and others regarding it as an estuary or marine formation), and from the number of extinct gigantic mammifers imbedded in it. It has, upon the whole, a very uniform character; consisting of a more or less dull reddish, slightly indurated argillaceous earth or sand, often, but not always, including in horizontal lines concretions of marl, and frequently passing into a compact marly rock. These concretions often unite into irregular strata, and cover very large tracts of country. The entire mass consists of a hard, but generally cavernous marly rock (*Tosca* or *Tosca-rock*); some of the varieties might be called calcareous tuffs." The formation thus described is ex-

trremely uniform in mineral character over the vast area of the Pampas; is regarded by Mr Darwin as having been slowly accumulated at the mouth of the former estuary of the Plata, and in the sea adjoining it; and as having been gradually elevated, like most of the southern latitudes of South America, above the waters of the ocean. It contains shells identical with those still inhabiting the adjacent seas, and is hence considered of recent or Pleistocene epoch, though imbedding the remains of numerous mammalia (megatherium, mylodon, glyptodon, toxodon, macrauchenia, &c. &c.) long since extinct, and bearing only a distant affinity to the sloths, armadillos, ant-eaters, and llamas of the present continent of South America.—See Darwin's 'Geological Observations on South America;' the 'Zoology of the Voyage of the Beagle;' D'Orbigny's 'Voyage dans l'Amerique du Sud,' &c.

Pampéro.—The name given in Buenos Ayres to a violent west wind, which, traversing the arid plains of the Pampas, raises whirl-clouds of dust and carries them forward to the coast of the Atlantic. The pamperos seem to be portions of the return, or north-western trade-winds.

Paper-Coal (Ger. *papier-kohle*).—A name given to certain layers of the Tertiary lignites, from their papery or leaf-like composition. They are evidently masses of compressed leaves; and when taken fresh from the beds, the venation and reticulations of many of the leaves are quite apparent. Beds of a similar composition, but more obscure in their structure, occur also in the older Coal formations.

Parabatrachus (Gr. *para*, along with, allied to, and *batrachos*, a frog).—A small batrachoid or frog-like reptile whose remains—bones of the head and teeth—have been discovered in the Coal-measures near Glasgow, and described in the 'Geological Journal,' vol. ix., by Professor Owen.

Paraffine, Paraffin (Lat. *parum*, little, and *affinis*, akin).—A well-known hydro-carbon obtained by distillation from petroleum, peat, pit-coal, and other bituminous minerals, and so termed from its remarkable chemical indifference to other substances. When pure it occurs as a tasteless, inodorous, fatty solid of a yellowish-white colour, fusible at 112°, and resisting the action of acids and alkalies. In its pure state it is now largely used for making candles; in a liquid form (*paraffin oil*) for lighting; and in a crude state, under the name of *mineral grease*, for lubricating machinery.

Paragenesis of Minerals (Gr. *para*, side by side with, and *genesis*, generation).—Applied in mineralogy to crystalline compounds whose mass is made up of crystals interblended in imperfect and sometimes even irregular forms. This innate structure arises either from the crystals of one mineral having been first formed and thus prevented the regular formation of the crystals of the other minerals; or from the whole mass having crystallised together, the individual crystals were prevented from attaining their full development by the growth of their neighbours, and thus all become locked and interlaced together in a congeries of mutually imbedded crystalline particles. The innate structures of granite, marble, loaf-sugar, and the like, are instances of paragenetic crystallisation.

Parámos (Span.).—The name given by the Spanish settlers to the high desert tracts of the Andes in South America.

Paramóidra.—A vernacular Irish term introduced by Dr Buckland in his account of some gigantic flints, thus popularly named, which occur in the Chalk near Belfast. They are found in other localities, and seem to

PAR

be gigantic pear-shaped or goblet-shaped zoophytes allied to the Sponges, but of so perishable a nature as to have left but few traces of their organisation. They are furnished with a cavity in their broad or upper end which extends downwards into the mass, and the narrow end shows indications of a pedicle by which they were attached to the sea-bottom. They have been found from one to three feet in length, and from half a foot to a foot in diameter.

Paréxus (Gr., a ladder or gangway).—A genus of Acanthodian fishes from the Lower Old Red Sandstone of Forfarshire, and so called from the notched or crenate striæ of their fin-spines, which were the organs first examined by Agassiz. In *Parexus*, which varies from a few inches to more than a foot in length, the head is of medium size, compressed; body short, deep, compressed, tapering; tail heterocerque, very large and deep; anterior dorsal spine long, slightly falcate, toothed on the posterior edge, ridged longitudinally, and crenate in the ridges; other spines with crenate ridges; four pairs of intermediate dermal scutes; scales medium-sized, smooth externally, interior surface sculptured. The deep compressed body, large broad tail, and high-toothed anterior dorsal spine, which is nearly half the length of the entire fish, are strongly distinguishing characteristics of *Parexus*.

Pargasite (Pargas near Abo in Finland).—Noble hornblende, or those varieties of hornblende possessed of high lustre and of a paler tint of green (olive or bottle-green) than common hornblende.

Paris Basin.—The great area of Tertiary strata on which Paris is situated—often alluded to in geology, and rendered classic by the palæontological discoveries and inductions of Cuvier. The basin extends about 100 miles from east to west, about 180 miles from north-east to south-west, and has a thickness of several hundred feet of marls, limestones, sandstones, sands, and clays. In descending section these strata present the following characters:—

1. *Upper fresh-water marls*, with interstratified layers of chert, aquatic and terrestrial remains.
2. *Upper marine formation*, consisting of marls, sands, and sandstones, and abounding in marine remains.
3. *Gypseous marls and limestones*; with fluviatile shells and bones of terrestrial animals.
4. *Calcaire Grossier*; alternations of marls, limestones, and calcareous sandstones—the various alternations containing terrestrial, fresh-water, estuarine, or truly marine remains, according to the prevailing agency and conditions of deposit.
5. *Plastic clay and sand*, containing fresh-water shells, drifted wood, lignite, leaves, and fruit; with bands of limestone enclosing marine shells.
6. *Basis of chalk-flints*, broken and partially rolled, and sometimes conglomerated into ferruginous breccia.

Pároxyzm, Pároxyzmal (Gr. *paroxysmos*, excitement, exasperation).—Applied in geology to any sudden and violent effort of natural agency, such as the explosive eruptions of a volcano, or the convulsive throes of an earthquake. Fissures, fractures, and uptiltings of the solid strata are the main indications of *paroxysmal* movements in former ages.

Parrot Coal.—The common Scotch name for cannel coal, from its spitting or flying in pieces with a crackling or "chattering" noise when suddenly placed in the fire. The miners usually distinguish the varieties

from their structure, as "slaty" or laminated parrots, "curly" or those breaking with short conchoidal fracture; from their colours, as "brown," "black," &c.; or from their qualities, as "dry" or gas parrots, "soft" or oil parrots, &c.—See CANNEL.

Particles (Lat. *particula*, a little part).—Strictly speaking, the minutest parts or atoms into which matter can be mechanically divided; but generally and loosely applied to the component parts or granules of all solid substances, as "particles of sandstone," "particles of chalk," and the like.

Parting.—Any thin subordinate layer occurring between two main beds, and forming, as it were, a *parting* or line of separation between them. "Partings" of shale are frequent between strata of limestone.

Pávonine (Lat. *pavo*, a peacock).—Having the changing iridescent lustre of the peacock's tail; applied to ores and metallic products which exhibit these brilliant hues.

Peach.—The name given by Cornish miners to chlorite and chloritic rocks, generally of a bluish-green colour and soft. A lode composed of this mineral is said to be a *peachy lode*.

Peacock (same as *pavonine*).—Applied to ores and minerals which exhibit an iridescent lustre like the changing hues of the peacock's tail, as "peacock copper," or copper pyrites when covered with an iridescent tarnish; "peacock coal," &c.

Pea-Grit.—A coarse pisolitic limestone forming part of the Inferior Oolite as developed in the south of England; and so called from its being composed of concretionary bodies, which are round, oval, or flattened, like crushed peas.

Pearl-Sinter.—A variety of siliceous sinter occurring in smooth and shining, globular or botryoidal masses, with a pearly lustre. Known also as *Fiorite*, from Santa Fiora in Tuscany, where it occurs incrusting volcanic tufa.

Pearlstone.—A variety of felspathic lava composed of a number of globules from the size of a grain of sand to that of a hazel nut, of a glassy or enamelled aspect and pearly lustre; whence the name. Pearlstone passes by insensible gradations into varieties of pumice.—See PITCHSTONE.

Peastone.—Technically known as *Pisolite*, which see. The "pea-stones" and "peastone grits" are common rocks in the Oolitic formation.

Peat (Sax.)—Peat, which is a product of cold or temperate regions, arises chiefly from the annual growth and decay of marsh-plants—reeds, rushes, equisetums, grasses, mosses, confervæ, and the like, being the main contributors to the mass, which in process of time becomes crowned and augmented by the presence of heath and other shrubby vegetation. Peat, or Peat-moss as it is often termed, has a tendency to accumulate in all swamps and hollows; and wherever stagnant water prevails there it increases, filling up lakes, choking up river-courses, entombing fallen forests, and spreading over every surface having sufficient moisture to cherish its growth. It occurs in all stages of consolidation, from the loose fibrous "turf" of the previous summer to the compact lignite-looking "peat" formed thousands of years ago. It is sometimes attempted to classify peat as *turf*, *hill-peat*, *bog-peat*, &c., according to the situations in which it occurs, or according to its texture and composition, as *fibrous*, *papyraceous*, *earthy*, *woody*, and *piciform*; but seeing that the whole is so irregularly and intimately blended, such distinctions are of little practical

value. Geologically, it may be considered as the youngest member of a series of which *lignite*, *coal*, and *anthracite* are earlier and more intensified mineralisations. Mineralogically, it constitutes the latest and least metamorphosed of the COAL FAMILY, which see; and, paleontologically, its organic contents are all of recent, though occasionally of locally extinct, species. Speaking of the peat of Denmark, Sir Charles Lyell remarks: "In the lower beds weapons of stone accompany trunks of the Scotch fir, while in the higher portions of the same bogs bronze implements are associated with trunks and acorns of the common oak. It appears that the pine has never been a native of Denmark in historical times, and it seems to have given place to the oak about the time when articles and implements of bronze superseded those of stone. It also appears that, at a still later period, the oak itself became scarce, and was nearly supplanted by the beech, a tree which now flourishes luxuriantly in Denmark. Again, at the still later epoch, when the beech-tree abounded, tools of iron were introduced, and were gradually substituted for those of bronze."

Pech-Uráne.—Known also as *Pitchblende*, and *uncleavable uranium-ore*; a proto-peroxide of uranium, occurring massive and disseminated, also reniform, with a curved lamellar structure; colour greyish or brownish-black; easily fractured; lustre imperfect metallic; specific gravity about 7. It is found in the lead and silver mines of Bohemia, and in Saxony, in Cornwall, and in North America. It is the principal ore of uranium; and is used in porcelain-painting, glass-colouring, and the like.

Pecopteris (Gr. *peko*, I comb, and *pteris*, fern).—*Comb-fern*. An extensive genus of fossil ferns occurring abundantly in the Coal-measures, less numerously in the New Red Sandstone and Oolite, and sparingly in Cretaceous and Lower Tertiary strata. It derives its name from the regular comb-like arrangement of its leaflets; and is characterised by the leaves being once, twice, or thrice pinnate, and by the leaflets having a perfect midrib, from which forked veins proceed more or less at right angles with it.

Pectolite (Gr. *pektos*, put together, and *lithos*).—A silicate of lime and soda, occurring in trap-rocks in spheroidal masses composed of an aggregation of acicular crystals, of a white or greyish-white colour and somewhat silky lustre. Known also as *soda table-spar*, *stellite*, from the star-like arrangement of its crystals, and *Ratholite*, from Ratho quarries near Edinburgh.

Pegmatite (Gr. *pegma*, compacted or congealed).—A binary granite composed of quartz and felspar—the felspar crystals lying impacted in the quartz as in a matrix. It occasionally contains flakes of silvery-white mica, and often passes into graphic granite.

Pelagic, Pelagian (Gr. *pelagos*, the deep sea).—Formed or deposited in deep water; belonging to the deep sea. Used in contradistinction to *littoral* or *estuary*, and characterised by a distinct flora and fauna.

Pele's Hair.—The name given in the Sandwich Islands to fine glassy threads of pumice carried off by the winds from the liquid lava-jets of the volcano of Kilauea—Pele being the goddess of this volcanic mountain. To the leeward the ground is often thickly strewn with this fine hair-like substance, many of the filaments having little knobs of volcanic glass at the one end, precisely like those drawn off from the molten mass of a glass furnace.

Pellicle (Lat. *pellicula*, a very thin membrane or skin).—Applied to any thin covering or coating of extraneous matter; as the nacreous "pellicle"

of some shells; the coaly "pellicle" which covers the stems of many fossil plants; and so on.

Pelorosaurus (Gr. *pelor*, monstrous or unusually gigantic, and *sauros*, lizard).—A term applied by Dr Mantell to one of the huge reptiles of the Wealden—certain vertebræ and other bones indicating a generic difference from the Iguanodon, and other dinosaurs of that formation.

Peltocaris (Gr. *pelte*, a half-moon shield, and *kari*, shrimp).—A genus of small phylloped crustaceans occurring in the Lower Silurian rocks of Britain, the carapace, on which the genus is founded, having the following characters:—round and shield-shaped; bivalved, the valves open and imperfectly joined along the dorsal line; deeply emarginate in front, the excavation so formed being filled up completely by a parabolic plate, which is the analogue of the rostrum and completes the broad oval shield.

Penarth Beds.—The term employed by the English Geological Survey to designate the "passage-beds" that lie between the Trias and Lias, from their typical development at Penarth in Somersetshire. Known also as *Rhaetic Beds*, *Kössen Beds*, *Zone of Avicula contorta*, &c., which see.

Penguin.—The Penguins, of which there are several genera, are, perhaps, the most natatorial or strictly aquatic of all birds, and occur in vast numbers in the seas of the southern hemisphere, ranging from New Guinea to within the antarctic circle. Remains of extinct species have been found in the Tertiary beds of New Zealand, and of existing species in old guano accumulations. The fossil, like the living genera, seem to be confined to the southern hemisphere.—See PALÆODYPTES.

Pentacrinus, **Pentacrinite** (Gr. *pente*, five, and *encrinus*).—A genus of encrinites abounding in the Lias, Oolite, and Chalk of England, and so termed from the *pentangular* or *five-sided* shape of its supporting column. In this genus, which is still represented by a solitary species in the West India seas, the pieces composing the receptacle are firmly articulated together, and the rays of the disc are fixed immediately to the summit of the column by special ossicles. The receptacle is small, and situated deep between the bases of the arms; it is closed by an integument covered by minute plates or flat ossicles. In many of the plumose pentacrinites the arms are very long and thickly fringed with side-arms and minute pinnae—all of which are composed of separate articulated ossicles, so that the number of bones in a single endo-skeleton of these crinoids is said to amount to from 50,000 to 150,000 distinct pieces.—See CRINOIDEA and ENCRINITE.

Pentamerus (Gr. *pente*, five, and *meros*, part).—Literally "five-parted," or "five-celled;" a palæozoic brachiopod belonging to the family *Rhynchonellidae*, and occurring characteristically in Upper Silurian and Devonian strata. The shell is ovate, ventricose, with a large incurved beak; valves usually plaited; foramen angular; no area or deltidium; and differs specially from *Terebratula*, *Rhynchonella*, and the like, in having an internal septum or plate by which the cavity is divided into four chambers; and in one valve the septum itself contains a cell—thus making in all five chambers, whence the name *Pentamerus* (five-parted).

Pentremite Limestone.—A term occasionally applied by American geologists to the Carboniferous Limestone of the United States, on account of the vast number of *Pentremites* which it contains.

Pentremites (Gr. *pente*, five, and *remos*, a board or plate).—A remarkable genus of Carboniferous crinoids, so termed from the five polygonal plates which compose their pear-shaped receptacle. In the *Pentremite* the column

is short, cylindrical, and furnished with irregular side-arms; the receptacle is composed of five polygonal plates, divided by five perforated grooves, which are of a petal-like form, and converge in a rosette on the summit; and from these perforations spring rows of articulated tentacles which are directed upwards over the vertex of the receptacle, apparently for the capture and retention of the animal's food.

Peperino.—An Italian term for a light porous species of volcanic rock, formed, like tufa, by the cementing together of sand, scoræ, cinders, &c.; and so called in allusion to the small peppercorn-like fragments of which it is composed. According to Mr Scrope, the Italian geologists restrict the term *tufa* to felspathic and pumiceous admixtures, which are grey or white, and apply the word *peperino* to the basaltic tuffs, which are usually brown.—See ALBANI STONE.

Perched Blocks.—The name given to detached blocks of rock which have been left by glaciers on the brows and ridges of lofty mountains. These blocks are often of large dimensions, and occur as relics of the glacial period on all the highlands of the northern hemisphere, as well as on the spurs and peaks of existing glacier-mountains.

Pércolate, Percolâtion (Lat. *per*, through, and *colo*, I strain).—Water passing through sand or porous sandstone is said to *percolate* such a medium; and in such a passage it is filtered or deprived of all mechanically-suspended impurities, as mud and clay; but it is not chemically affected, unless it may have taken up some new ingredient from the strata through which it has percolated.

Periclinal (Gr. *peri*, all around, and *kline*, I bend).—Dipping on all sides from a central point or apex; applied to strata which often dip in this manner from some common centre of elevation.

Perigee (Gr. *peri*, around, about, and *ge*, the earth).—That point of a planet's orbit at which it is nearest to the earth; its *apogee* being the point at which it is farthest off.

Peristerite (Gr. *peristera*, a pigeon).—A variety of Albite, or perhaps of Labradorite, occasionally containing disseminated grains of quartz, and exhibiting when cut in a proper direction a fine delicate opalescence, like the changing hues of a pigeon's neck, whence the name.

Pérmeable (Lat. *per*, through, and *meo*, I pass).—Admitting the passage of water; applied to rocks and rock-materials sufficiently porous to permit the passage of water through their pores and interstices.

Permian System.—The lower or paleozoic division of what was formerly regarded as the New Red Sandstone—the term *Permian* having been introduced by Murchison in 1841 (to harmonise with his Silurian and Devonian), from the fact that these strata were typically and extensively developed in the government of Perm in Central Russia. Some German geologists have attempted to introduce the term *Dyas*, to harmonise with that of *Trias*, but as yet with no success among British geologists. In the vast and undisturbed region of Perm the system consists (according to Murchison) of three main members, which may be arranged in descending order, thus:—

3. Conglomerate and sandstone, with plants and fossil reptiles.
2. Red sands, with copper ore and many plants.
1. Sandstones and grits; limestones in various courses, with characteristic fossils, associated with marls and gypsum, the marls occasionally containing plants, and also seams of impure coal.

PET

In the north of England (more especially in Durham and Yorkshire) it is composed chiefly of red sandstone and grits, of magnesian limestones and gypseous marls, and of laminated calcareous flagstones. This succession is usually tabulated as follows:—

	LAMINATED LIMESTONE, with layers of coloured marls, as at Knottingley, Doncaster, &c.
	GYPSEOUS MARLS—Red, bluish, and mottled.
MAGNESIAN LIMESTONE.	MAGNESIAN LIMESTONE—Yellow and white; of various texture and structure; some parts, as at Tynemouth, brecciated, or made up of fragmentary masses.
	MARL SLATES—Laminated, impure calcareous flagstones of soft argillaceous or sandy nature.
RED SANDSTONE.	RED SANDSTONE, with red and purple marls, and a few micaceous beds. The grits are sometimes white or yellow, and pebbly. When conformable, this sandstone occasionally passes into the Coal-measures on which it rests.

In France, Germany, North America, and other tracts where the system has been investigated, some of these members are wanting, while others are more fully and typically developed. It has been attempted to co-ordinate, as in the subjoined synopsis, the English and German strata, taking the north of England and Thuringia as the points of comparison.

<i>England.</i>	<i>Germany.</i>
Laminated limestones.	Stinkstein.
Brecciated limestones.	Rauchwacké.
Fossiliferous limestones.	Dolomit; upper zechstein.
Compact limestone.	Zechstein (mine-stone).
Marl slate.	Mergel-schiefer and kupfer-schiefer.
Red sandstones and grits.	Rothe-tode-liegende.

Paleontologically, the fossils of the Permian system present a decidedly palæozoic aspect—the plants being akin to those of the Coal-measures, together with Carboniferous genera of corals, polyzoa, crinoids, shell-fish, fishes with heterocercal tails, and labyrinthodont reptiles.—See NEW RED SANDSTONE.

Petrology, sometimes **Petrology** (Gr. *petra* or *petros*, a rock, and *logos*, discourse).—Literally, “the science of rocks,” and often used synonymously with *Lithology* or *Physical Geology*, which restrict themselves solely to the consideration of rocks and rock-formations, without reference to the organic remains they contain.—See LITHOLOGY.

Petrified Figs.—The name given by collectors to compressed specimens of the Tertiary fruit known as NIPADITES, which see.

Petrify, Petrification (Lat. *petra*, a stone, and *fio*, I become).—Literally, to convert or change into stone. When a shell, bone, or fragment of wood, by being enclosed in calcareous mud or other sedimentary matter, becomes hard and stony, it is said to be *petrified*. Petrification is thus caused by the particles of stony matter entering, while in solution, into the pores of the vegetable or animal tissue, and as the organic matter disappears, gradually taking its place, particle after particle, till the whole is converted into stone. The term “petrifications” is thus often used as synonymous with “fossils” and “organic remains.”

Petrography (Gr. *petron* and *graphe*).—Frequently used in the same sense as *Petrology*; hence we speak of the “petrographic” character of a formation in contradistinction to its “palæontological.”

Petróleum (Lat. *petra*, rock, and *oleum*, oil).—Literally “rock-oil;” a liquid mineral pitch or bitumen, so called from its oozing out from certain strata like oil. It is usually of a dark yellowish-brown colour, more or less liquid according to external temperature, and consists of 88 carbon and 12 hydrogen. It occurs in various formations, chiefly in connection with fields of coal and lignite, and appears to arise from the decomposition or distillation of these strata by subterranean heat. Known also as *Mineral Oil*; hence the “oil-wells” of America, Canada, Burmah, and other regions, which are now largely worked for distillation into paraffine oil, paraffine, and other similar products.—See **BITUMEN**.

Petrophiloides.—Fossil cones, chiefly from the London Clay, and so named from their resemblance to those of the existing *Petrophila* of New Holland, which belongs to the natural order Proteaceæ—an order of evergreen shrubs or small trees, with hard dry leaves, and now almost exclusively confined to the southern hemisphere.

Petrosilex (Lat. *petra*, rock, and *silex*, flint).—Literally “rock-flint,” in contradistinction to the detached nodular flints of the Chalk formation. A synonyme of hornstone, though sometimes applied to the harder kinds of compact felspar, which pass insensibly into hornstone.

Petuntze (Chin.).—A quartz-felspathic rock used in China in the manufacture of porcelain.

Petworth Marble.—A limestone of the Wealden formation, so called from its being worked at Petworth in Sussex; known also as “Sussex marble.” It is chiefly composed of shells of the *Paludina* or river-snail, together with cases of *Cypria*, and occasional shells of *Unio*, *Cyclas*, and other fresh-water genera. It is described by Dr Mantell “as an aggregation of *Paludina*, held together by crystallised carbonate of lime, the cavities of the shells and their interstices being often filled with white calcareous spar.”

Peuce, Peuceites (Gr. *peuke*, the fir-tree).—The generic term for all fossil wood that appears absolutely coniferous, in contradistinction to *Pinites*, which only exhibits approximations to the true coniferæ. Both have a central pith, wood in concentric layers, bark, and medullary rays, but with no vessels. In *Pinites*, the cells of the woody fibre are *reticulated*; in *Peuceites*, they are marked with oblong deciduous areolæ, having a circle in the middle.—(*Brongniart*.)

Pfahlbauten (Ger.).—Literally “pile-dwellings;” the term applied by Swiss archaeologists to the prehistoric lake-habitations of that country. Since 1854 much attention has been directed to these ancient dwellings, as may be gathered from the works of MM. Troyon, Keller, Morlot, and others—all of them agreeing that this mode of habitation seems to have been common during the stone and bronze periods, and even during the earlier part of the iron period. Herodotus relates that in the time of Darius (about 520 B.C.) there existed a similar settlement in the middle of Lake Prasias, in Pæonia (now probably Lake Takinos, in the modern Turkish province of Roumelia). “The houses,” he says, “were built on a platform of wood, supported by wooden stakes, and a narrow bridge, which could be withdrawn at pleasure, communicated with the shore.” “When man,” says M. Morlot, “thus stationed his dwellings on piles, all the refuse of his industry and of his food were naturally thrown into the lake, and were often well preserved in the mud at the bottom. If occasionally such establishments were burnt, whether intentionally by the

enemy or by accident, a vast quantity and variety of articles, including some of great value, would sink to the bottom of the waters. Such aquatic sites were probably selected as places of safety, since, when the bridge was removed, they could only be approached by boats, and the water would serve for protection alike against wild animals and human foes." In the older Pfahlbauten of Switzerland the implements are chiefly of *stone*, and associated with the castaway bones of the deer, boar, and wild-ox; in those of intermediate age *bronze* implements prevail, associated with the bones of the domestic ox, pig, and goat; while in the more recent, *iron* swords and spears have been found, accompanied by carbonised grains of wheat and barley, and with fragments of rude textures woven of flax and straw. The more recent seem to have been anterior to the great Roman invasion of northern Europe; the more ancient may be many thousands of years older than that event. For full details of these "Lake-Dwellings," as also of the prehistoric "Shell-Mounds," "Earth-Mounds," "Cave-Dwellings," and the like, the reader may refer to Lubbock's 'Prehistoric Times,' as yet the most compendious English work devoted to these archaeological subjects.

Phacops (Gr. *phake*, a pea or lentil, and *ops*, the eye).—A widely distributed genus of trilobites, remarkable for the large facets of the eyes, hence the name. In *Phacops*, the trilobation is boldly distinct; the thorax consists of eleven segments; and in some species (*P. caudatus*) the tail is greatly prolonged and pointed.

Phanerite Series (Gr. *phaneros*, evident).—A term employed by Dr Fleming in his 'Lithology of Edinburgh' to designate the uppermost stage of the modern epoch, as consisting of deposits produced by causes in ordinary operation, and whose origin is evident, as compared with the brick-clays and boulder-clays (the *Akumite* and *Taragmite* series) which lie beneath.—See MODERN EPOCH.

Phanerogamic, Phanerogamia (Gr. *phaneros*, evident, and *gamos*, marriage).—Applied to those plants whose organs of reproduction (flowers and seed) are apparent, in opposition to the *Cryptogamic*, which have no visible flowers or organs of reproduction.—See BOTANY.

Phascólomys (Gr. *phaskolos*, a pouch, and *mus*, mouse).—Literally "pouched or marsupial mouse;" the wombat of Australia, fossil species of which (*P. gigas*) have been found in the uppermost Tertiaries of that country, rivalling the tapir in magnitude.

Phasclothérium (Gr. *phaskolos*, a pouch, and *therion*, animal).—A small marsupial (or pouched) mammal from the Oolitic calcareous flagstones of Stonesfield. The jaws and teeth are the only remains yet found, and these seem to indicate an affinity with marsupial genera now restricted to New South Wales and Van Diemen's Land, hence the name.

Phaseolites (*phaseolus*, the kidney-bean).—A genus of leguminous plants found in the Tertiary fresh-water formation of Aix, having unequally pinnate compound leaves; leaflets entire, disarticulating, with nearly equal reticulating veins.

Phlebópterys (Gr. *phleps*, *phlebos*, a vein, and *pterys*, fern).—A genus of Oolitic ferns, characterised by their pinnæ being in contact with each other at the base, and by their veins (which are simple or forking) being separated from the midrib by a row on each side of hemi-hexagonal *areolæ*, or space destitute of veins.

Phocænópsis.—A provisional genus of cetaceans from the Pliocene, or

perhaps Pleistocene, clays of New Zealand; and so named by Professor Huxley, from the resemblance of the remains to those of the common porpoise (*Phocæna*) of our own seas.

Phœnicites.—From *Phœnix dactylifera*, the date-palm; a generic term employed to embrace fossil palm-leaves of the pinnated form, in contradistinction to *Flabellaria*, or those having broad fan-like leaves. *Phœnicites* have been found only in Tertiary strata.

Pholádidae (Gr. *pholeo*, I bore).—The family of boring bivalves, of which the common *pholas* or piddock is the type. In these borers the shell is gaping at both ends, thin, white, brittle, and exceedingly hard; armed in front with rasp-like imbrications; without hinge or ligament, but often strengthened externally by accessory valves. They perforate all substances softer than their own valves, and are found from the Lias upwards.

Pholadomya (Gr. *pholeo*, I bore, and *mya*, the gaper).—A genus of fossil equivalved shells, with the posterior end short and rounded, and the anterior elongated and gaping. The surface is generally marked with rib-like elevations, diverging obliquely from the beak to the margin. They occur in the Lias, Oolite, and Chalk formations.

Pholidogaster (Gr. *pholis*, *pholidos*, scale or scute, and *gaster*, belly).—A genus of labyrinthodont reptiles founded by Professor Huxley on a specimen from the Gilmerton coal-field near Edinburgh, and differing from *Archegosaurus* in the form of the head, the extent to which the ossification of the vertebral column has proceeded, and in the character of its dermal armour. It shares with that genus, however, the peculiarity of having its overlapping scales arranged in double oblique series between the pectoral and pelvic arches only; hence the name.

Phónolite (Gr. *phone*, sound, and *lithos*, stone).—A mineralogical term occasionally employed for CLINKSTONE, which see.

Phosphatic Nodules.—A familiar term for those concretions and nodules of phosphate of lime which occur in layers and bands in the gault and upper greensand of the Chalk formation, and which have recently come into use for manurial purposes. They are found abundantly at Farnham in Surrey, at Folkestone in Kent, near Cambridge, and other places; and are evidently of animal origin, being partly coprolitic, and probably the excrement of fishes. Similar nodules and concretions are also obtained from the Crag formation near Felixstow, apparently derived from the waste of the London Clay; and these, it is said, often contain so much as 50 per cent of available phosphate of lime. They are prepared by being ground into powder, and converted into the manurial superphosphate by the action of sulphuric acid.

Phosphorite.—A massive variety of *apatite* or native phosphate of lime, occurring in veins in the crystalline or metamorphic rocks. It contains more fluorine than the crystallised varieties.

Phyllites (Gr. *phyllon*, a leaf).—A general term for all fossil monocotyledonous leaves in which the principal veins converge at both the base and apex, and are connected by transverse or secondary veins. *Dictyophyllites* are those having a reticulated venation, and, of course, dicotyledonous.

Phyllogræpus (Gr. *phyllon*, leaf, and *græpus*).—Literally "leaf-graptolite;" a Lower Silurian organism, known also as *Graptopora*. "It combines," says Mr Salter, "with the shape and general character of the

net-like Bryozoa, the texture and the form of the cells of the graptolite, and may be regarded as a bundle of these animals united by processes into a reticulated cup." Some curiously complex branched forms of graptolites, discovered by Sir W. Logan in Canada, complete the chain of affinities between the Graptolites and the Fenestellida.

Physalite (Gr. *physis*, to blow or swell up).—A coarse variety of topaz occurring in large crystals (some amounting to 80 lb. in weight); and so named from its intumescing when heated. Known also as *pyrophysealite*, for the same reason of its swelling up under heat.

Physiography (Gr. *physis* and *graphe*).—A term occasionally used, and especially by American writers, as synonymous with Physical Geography; a description of existing nature as displayed in the surface-arrangement of the globe—its features, atmospheric and oceanic currents, climates, magnetism, life, &c., as well as the changes or variations to which these are subjected.

Physiology (Gr. *physis*, nature, natural capacity or constitution, and *logos*, discourse).—Literally "the science of natural function or capacity." Usually applied to that department of Biology which treats of the vital actions or *functions* performed by the organs of plants and animals. Morphology, on the other hand, merely takes cognisance of the form, order, and arrangement of these organs.

Phytography (Gr. *phyton*, plant, and *graphe*, I write).—Descriptive Botany; the science which describes the characters, habits, distribution, functions, and properties of the vegetable kingdom.

Phytolithus (Gr. *phyton*, a shoot, and *lithos*).—An old generic term for such stems as *stigmara*, *favularia*, and the like; used by Martin, Parkinson, Steinhauer, and others.

Phytology (Gr. *phyton*, a plant, and *logos*, discourse).—The science of the vegetable kingdom; used as synonymous with *Botany*: hence the term PALÆOPHYTOLOGY, or the science which treats of extinct or fossil vegetable forms.

Phytophagous (Gr. *phyton*, a shoot or plant, and *phago*, I eat).—Plant-feeding, plant-eating; a term applied to animals which live on vegetables, in contradistinction to those that are *zoophagous*, or prey on the flesh of others.

Phytopsis (Gr. *phyton*, a shoot; *opsis*, resemblance).—A provisional genus of the so-called fucoid of the Lower Silurian strata of North America, but regarded by Mr Salter as the vertical tubes, or rather the filled-up burrows, of marine worms.—See BIRDS-EYE LIMESTONE.

Pigotite (after Rev. M. Pigot).—A mineral compound of alumina and mudeoseous acid of a brownish-yellow colour found in crusts and layers in certain caverns—the organic matter from the vegetation above being carried in through rents and fissures by rain-water, where, meeting with the alumina of the decomposing rocks, it forms the compound in question. In some of the granitic caverns on the coast of Cornwall it forms crusts from two to three inches in thickness.

Pinite.—A variety or sub-species of iolite, deriving its name from the Pini mines near Schneeberg, and known also as *Gieseckite*. It is essentially a silicate of alumina (55 silica, 25 alumina), with iron protoxide, magnesia, and water, and occurs chiefly in granite and felspar porphyry—more rarely in gneiss and mica-schist.

Pinites (Lat. *pinus*, the pine-tree).—The generic term for all fossil

wood which exhibits structural approximations to the Coniferous order; undoubtedly coniferous remains being ranked under the term *Pecucites*. Remains of both occur in the Coal-measures and upwards; but the existing genus *pinus* has not been found earlier than in Pleistocene or uppermost Tertiary deposits.—See *PECUCITES*.

Pinnulária (Lat. *pinná*, a feather).—One of Lindley's provisional genera of Coal-measure plants, "occurring in small fragments, consisting of a slender stem (or root), from which, at regular distances on opposite sides, spring capillary appendages divided in a pinnated manner." Numerous root-like fragments like *myriophyllites*, *pinnularia*, &c., occur in the Coal-measures, but we know little or nothing of their connection or affinities.

Pinus (the *Pine-tree*).—The existing genus *Pinus* has not been found earlier than in Pleistocene deposits; it is readily distinguished by its leaves growing in twos, threes, or fives in the same sheath; and by its cones, which are composed of scales that enlarge at the apex into a rhomboidal disc.

Pisiform (Lat. *pisum*, a pea).—Occurring in small concretions like pease; e.g., Pisiform iron-ore.

Pisolite (Lat. *pisum*, a pea, and *lithos*, stone).—Literally "pea-stone;" a concretionary limestone, so called from its resemblance to an agglutination of pease. In "roestone" or "oolite" the component rounded grains or globules are small; in "pisolite," as the name implies, they are considerably larger. These calcareous spherules are composed of concentric laminae, which commonly have a particle of sand, a fragment of shell, or other organic substance, as a nucleus. They owe their formation to the deposition of successive concretions around the included body while subjected to the action of water in which a rotatory motion is induced; and the spheroids continue to increase until they become too heavy for further transport, and then subside, and are consolidated by subsequent infiltration. The springs near Carlsbad deposit a beautiful pearly-looking *pisolite*, some portions of which are sufficiently compact to admit of being polished and manufactured into boxes and other ornaments.

Pistacite.—Iron and lime epidote, in which a large quantity of the lime is replaced by protoxide of iron, and a large proportion of the alumina by the peroxide—occurs in prismatic crystals, and also granular, earthy, or in crusts; and so called from its pistachio-green colour.

Pitchstone.—A glassy rock of the trappean division, usually occurring in dykes and disrupting masses; and so called from the pitch-like aspect of its fresh conchoidal and splintery fracture. It is generally black, greyish or greenish black; and is occasionally porphyritic (pitchstone porphyry), from the presence of small spherical concretions, termed *sphaerulite*. It is classed by mineralogists along with obsidian, pumice, and pearlstone, under the head of *amorphous felspar*—the glassy amorphous nature of these rocks being apparently owing to their rapid cooling from a state of fusion.

Placodermata, Placoderms (Gr. *plax*, a plate, and *derma*, skin or covering).—Dr Pander's term for the bony-plated or bone-encased fishes of the Old Red Sandstone—*Coccosteus*, *Pterichthys*, *Cephalaspis*, and the like.

Placoganoid, Placoganoides (Gr. *plux*, a plate, and *ganos*, splendour).—A sub-order of the Ganoid fishes, and so termed because the head and more or less of the body is protected by large ganoid, often reticulated

plates. The *Placoganoids* are richly represented in the Devonian epoch and disappear in the Carboniferous; whereas the other sub-order, the *Lepidoganoids* or scale-covered ganoids, begin at that period to increase in numbers.

Placoid, Placoidæan (Gr. *plax*, a plate, and *eidos*, form).—The first order of fishes in the arrangement of Professor Agassiz. They are characterised by having their skin covered irregularly with plates of enamel, often of considerable dimensions, and sometimes reduced to small points like the shagreen on the skin of many sharks, and the prickly tooth-like tubercles on the skin of rays. All the cartilaginous fishes, with the exception of the sturgeon, belong to this order, which includes the skates, rays, dog-fish, and sharks.

Plagiailax, an abbreviation for *Plagiailacodon* (Gr. *plagios*, oblique; *aulax*, groove; and *odous*, tooth).—A small herbivorous marsupial, whose teeth and jaws have been found in the Purbeck beds of the Oolite; and so named in reference to the diagonal grooving of the premolars.—(Falconer in 'Geological Journal,' vol. xiii.)

Plagiostoma (Gr. *plagios*, oblique, and *stoma*, the mouth).—A generic term applied to certain compressed, obliquely-oval bivalves of the Oyster family, which are found fossil from the Trias upwards. They are now ranked under the synonyme *Lima*, and partly under *Spondylus*, both of which see.

Planerkalk, Planerkalkstein.—Literally "plain-limestone;" the German name for the upper member of the Chalk formation in Saxony; in contradistinction to the *Bergkalk* or Mountain-limestone. The equivalent in part of our White Chalk.

Planorbis (Lat. *planus*, flat, and *orbis*).—A genus of fresh-water shells distinguished by their discoidal form, the whorls of the shell being coiled up in a nearly vertical plane. There are about sixty living species, and about the same number are enumerated from Wealden and Tertiary strata.

Plaster of Paris.—The familiar designation for the cement or plaster obtained from gypsum or sulphate of lime, and so called from its being first prepared in the neighbourhood of Paris. Gypsum or sulphate of lime, when calcined, is not decomposed (as common limestone is, by parting with its carbonic acid), but simply loses its water of solidification. It is then reduced to a white powder; and when this is again mixed with water, it absorbs a certain portion, and the mass becomes a solid plaster or cement. The white powder is usually sold under the name of "Plaster of Paris," and is largely used in the arts.

Plastic (Gr. *plastikos*, suitable for being wrought or fashioned).—Applied to substances which, like clay, are capable of being fashioned or moulded into any desired form; also to the skill or power of so fashioning; hence we speak of the "plastic art," the "plastic power of nature," and so forth.

Plastic Clay.—"The clays called *Plastic*," says Lyell, "which lie immediately below the London Clay, received their name originally in France, from being often used in pottery. Beds of the same age (the Woolwich and Reading series of Prestwich) are used for the like purpose in England." As a series, the Plastic Clay of England constitutes the middle portion of the Eocene group, and consists of plastic or mottled clays and sands, and well-rolled flint pebbles. It is partly of marine and partly of fresh-water formation, and is characterised by two species of oyster (*O. bellouvacina*

and *edulina*), and some fresh-water shells, as *Melania*, *Cyrena*, *Unio*, *Paludina*, &c. It is the equivalent of the French *Argile Plastique et Lignite*.

Plate.—A north of England mining term for compact beds of shale, which, when exposed to the weather, break up into thin plates or laminae.

Plateau (Fr.)—Literally "a platform;" introduced by the French geographer Buache, and applied to any elevated and comparatively flat surface of land; a *table-land*, or high level region.—See **TABLE-LAND**.

Platina, Platinum (Span. *platina*, from *plata*, silver, in allusion to its colour).—A metal, discovered in 1741, in the mines of Cliveo in Peru. It occurs only in the metallic state, associated or combined with various other metals, such as copper, iron, lead, titanium, chromium, gold, silver, palladium, rhodium, osmium, and iridium. It is usually in rounded grains, or flattened pellets, of a metallic lustre and white colour, mixed with sand and other impurities. When pure it has very much the colour of silver, but of inferior lustre. It is the heaviest of known metals, its specific gravity, after hammering, being about 21.5. It is exceedingly ductile, malleable, tenacious, and difficult of fusion, but capable of being welded at a high temperature. It undergoes no change under the combined agency of air and moisture; resists the strongest heat of a smith's forge; but can be melted by voltaic electricity, or by the oxyhydrogen blow-pipe. It is not acted upon by any of the pure acids, but is dissolved by chlorine and nitro-muriatic acid, and is oxidised at high temperatures by pure potassa and lithia. It is much used by chemists and in chemical operations for crucibles, evaporating dishes, alembics, and the like; and forms alloys with most of the other metals.

Platinoids.—Platina being invariably found associated with several other metals, forming a family apart of very singular chemical habitudes, the term *Platinoids* has been applied to the group, which embraces palladium, rhodium, iridium, osmium, ruthenium, and one or two others still doubtfully ascertained, to which the names *astræum* and *hebeum* have been proposed by Sir J. Herschel.

Platycephalic (Gr. *platys*, broad, and *kephale*, the head).—Broad-headed; flat-handed; e.g., the flat-skulled tribes of the human family.

Platyérinus, Platyérinite (Gr. *platys*, broad).—A genus of encrinurites peculiar to the Carboniferous limestone, and so termed from the flatness and breadth of the basal and radial plates of the receptacle.

Platysómus (Gr. *platys*, broad, and *ómos*, the shoulder).—One of the pycnodonts; a ganoid fish of the Carboniferous and Permian epochs, and so called from its deep bream-like body, which is covered with strong rectangular scales arranged in bold transverse rows. Head rather small; eye-orbits large; tail sharply heterocerque.

Pleistocene (Gr. *pleistos*, most, and *kainos*, recent).—Literally, "most recent;" that is, the most recent or uppermost of the Tertiaries, a term implying that the organic remains in such accumulations belong almost wholly to existing species. Sir Charles Lyell makes use of the word *Post-pliocene*, and others employ the term *Pleistocene* as equivalent to *Post-tertiary*; but, properly speaking, the organic remains of the Post-tertiaries belong exclusively to species still existing, while those of the Pleistocene embrace a few extinct forms. As it is impossible to draw sharp lines of demarcation between different formations, the *Pleistocenes* may be regarded as the passage-beds between Tertiary and Post-tertiary formations.

Plesiosaurus (Gr. *plesios*, near to, and *saurus*, a lizard).—A genus of marine reptiles (of which there are known about twenty species), occurring from the Lias to the Chalk inclusive; and so named from its being much more lacertilian in structure than the ichthyosaurus, from which it differs in the smallness of the head, the enormous length of neck, which consists of from twenty to forty vertebrae, and in other osteological peculiarities. "This reptile," says Mantell, "combines in its structure the head of a lizard, with teeth implanted in sockets like the crocodile—a neck resembling the body of a serpent—a trunk and tail of the proportions of those of a quadruped—with paddles like the turtle. The vertebrae are longer and less concave than in the ichthyosaurus; and the ribs, being connected by transverse abdominal processes, present a close analogy to those of the chameleon." Specimens have been found, and some of them almost entire, ranging from ten to twenty feet in length.—See **ICHTHYOSAURUS**.

Pleuracanthus (Gr. *pleuron*, the side, and *acantha*, a thorn or spine).—A genus of ichthyodontoïdes or fin-spines occurring in the Carboniferous formation, and characterised by their having a row of sharp hooks or denticles on either side; whence the name. According to Agassiz, they belong to the fossil family **TRYGONIDÆ**.

Pleurodont (Gr. *pleuron*, the side, and *odon*, tooth).—A term applied by Professor Owen to those inferior or squamate saurians which have the teeth ankylosed to the bottom of an alveolar groove, and supported by its side.—See **THECODONT**.

Pleurotomaria (Gr. *pleuron*, a side, and *tome*, a notch).—An extensive genus of fossil shells belonging to the gasteropod family *Haliotidæ*, and comprising about 400 species, which range from the Lower Silurian to the Chalk inclusive. The shell resembles that of the *Trochus*, is solid, few-whorled, and has its surface variously ornamented—the colour being still preserved in some specimens; the aperture is somewhat square, and has a deep slit in its outer margin; hence the name. The part of the slit which has been progressively filled up forms a prominent band round the whorls. "In this extensive group," says Woodward, "there are some species which rival the living turbines in magnitude and solidity, whilst others are as frail as ianthina."

Plinthophorus (Gr., literally *bearing tiles*, in allusion to the bony scutes on its sides).—A genus of fishes from the Lower Chalk, distinguished by the following characters, as described by Dr Günther: "Body oblong, apparently scaleless, but with a dorsal and ventral series of imbricate, arrow-shaped osseous scutes on each side. Dorsal fin rather short, placed in the middle of the total length, above the ventrals; anal short, at some distance behind the dorsal; caudal fin forked. Pectorals and ventrals well developed, without osseous spine, the latter nine or ten-rayed." Related to *Rhinellus*; but whether Ganoidean or Teleostean cannot be decided from the imperfect state of the specimens.

Pliocene (Gr. *pleion*, more, and *kainos*, recent).—Sir Charles Lyell's term for the Upper Tertiaries, as containing more, or a greater percentage, of recent testacea than the Miocene or Eocene. In 1830, according to the enumeration of M. Deshayes, the percentages were, *Pliocene*, 35 to 50; *Miocene*, 17; and *Eocene*, only 3½. In the "Newer Pliocene" or uppermost Tertiaries of Lyell (the *Pleistocene* of many authors) the percentage increases to 90 or 95.

Pliólophus (Gr. *pleion*, more, and *lophion*, a small crest).—A small *lophi-*

odont mammal, whose remains have been found in Eocene and Miocene Tertiaries, and so named by Professor Owen because it seems to be *more near* to the lophiodont type than its close ally the *hyracotherium*.—See LOPHIODON (Jour. Geol. Soc., vol. xiii.)

Pliopithecus (Gr. *pleion*, more, and *pithecos*, ape).—An extinct ape from the Miocene deposits of the south of France, and so named by Gervais from its resemblance to the tailed monkeys (*semnopithecus*) of Southern Asia.

Pliosaurus (Gr. *pleion*, more, and *sauros*, lizard).—A marine reptile of the Upper Oolites, intermediate in structure between the Plesiosaur and Ichthyosaur; literally “more lacertilian” than the common ichthyosaurus. With the exception of the teeth, which are thicker and stronger, the vertebrae of the neck, which are short and compressed, and the more massive proportions of the jaws and paddle-bones, the framework of *pliosaurus* closely accords with that of *plesiosaurus*.

Plumbago (Lat. *plumbum*, lead).—One of the names given to Graphite or Blacklead, from its resemblance to an ore of lead.—See GRAPHITE.

Plumbiferous, Plombiferous (Lat. *plumbum*, lead, and *fero*, I yield or bear).—Applied to veins, strata, or other matrices yielding or containing any of the ores of lead.

Plum pudding-Stone.—Originally applied to a very pretty conglomerate of flint pebbles cemented together by a siliceo-calcareous matrix, polished sections of which had a fanciful resemblance to the fruit in a slice of plum-pudding,—now loosely applied to all conglomerates.—See PUDDING-STONE.

Plutonic (*Pluto*, the god of the inferior regions).—Applied to igneous rocks found at some depth beneath the surface of the land or sea, as distinct from *Volcanic*, or those thrown up to, and consolidated on the surface. As a class, the Plutonic are more crystalline, and exhibit more structure than the Volcanic—characteristics apparently induced by the greater pressure under which they were cooled and consolidated.

Pluvial (Lat. *pluvius*, rainy).—Of or belonging to rain; applied to operations and results that arise from or depend on the action of rain. Thus we speak of the denuding or degrading effects of “pluvial agency,” just as we speak of “atmospheric,” “fluvial,” or other similar agency.

Pluviometer (Lat. *pluvius*, rain; *metron*, a measure).—An instrument for catching falling rain, so as to determine the amount that falls at any given locality within a given period; a rain-gauge, of which there are several varieties in use by meteorologists.

Poacites (Lat. *poa*, the meadow-grass).—The generic term for all fossil monocotyledonous leaves, the veins of which are parallel, simple, of equal thickness, and not connected by transverse bars. In the mean time *Poacites* takes rank under the *Gramineæ* or grasses, though, from the great length and breadth of many of the Coal-measure species, it is more than probable that some of them may be the leaves of pinnated palms.—See PHYLITES.

Podosphénia (Gr. *pous*, *podos*, the foot, and *sphén*, a wedge).—A genus of Diatoms or microscopic plant-growths, deriving their name from their wedge-shaped frustules, which in youth are attached by the small end, but afterwards become free. They are said to be chiefly marine, and abound in the polishing-slate of Bilin.

Poikilitic, Pœcilitic (Gr. *poikilos*, variegated).—A term applied by the earlier English geologists to the Upper New Red Sandstone, in allusion to the variegated colours—red, green, purplish, &c.—of its marls and sandy

shales. The *Bunter Sandstein* of the Germans; the *Terrain Pacilien* of the French.

Polders (Dutch).—The name given in Holland to the low fertile lands, reclaimed by vast systems of dykes and embankments from the sea. The soil of the "polders" consists of muddy deposits, mixed with comminuted shells and fine sea-sand; in other words, it is a fine marine silt rendered fertile by the abundance of its organic debris.

Poles (Gr. *polos*, I turn).—The extremities of the axis or imaginary line round which the earth turns in her daily rotation. They are respectively the North and South, or the *Arctic* and *Antarctic Poles*; and the districts therewith connected are known as the *Polar Regions*. By prolonging the earth's axis towards the apparent celestial concavity in which the earth rotates, we form, in like manner, the *Poles of the Heavens*, north and south; and hence the *Pole* or *Polar Star*, from its proximity to the pole of the heavenly vault.

Polierschiefer (Ger.)—Polishing-slate; a slaty infusorial or rather microphytal rock, the same as the *tripoli* of Bilin, &c., and so termed from its being used as a polishing powder.

Pollux.—Castor and Pollux, two closely allied minerals of the Felspar family; hence their names by Breithaupt. They resemble quartz in their hardness, transparency, and vitreous lustre, and are the most siliceous of the crystalline silicates.

Polyparium (Lat.)—The common framework or endoskeleton of any group of polypes; the secreted matter by which they are united into one colony, whether fleshy, horny, calcareous, or siliceous.—Same as *Poly-pidom*, which see.

Pôlypes, Polypi (Gr. *polys*, many, and *pous*, foot).—The zoological term applied to those radiated animals which are furnished with many tentacula or foot-like organs of prehension surrounding the mouth or free orifice; as the "fresh-water polype" or hydra, the "coral polype," &c.—See ZOOPHYTA.

Polypidom (*polype*, and *domus*, a house).—A name given to the stems and permanent fabrics of zoophytes, around or in which are placed the little cells containing the polypes or animals which construct the mass. In some the polypidom is horny and flexible like the *gorgonia* or sea-fan; in others, as the common madreporé *coral*, it is strong and calcareous; and in others it is membrano-calcareous. In the stony or lime-secreting genera this endoskeleton, polypidom, polyparium, or common support, becomes the well-known *Coral*, the aggregation of which constitutes those vast *Reefs* that rival in magnitude the limestones of the earlier formations.

Polyporites.—Literally "many pores;" the name given by Dr Lindley to a fungus like organism from the Coal-measures of Wales, from its resemblance to the existing *Polyporus versicolor*.

Polyptychodon (Gr. *polys*, many; *ptyche*, a fold; and *odous*, tooth).—A Cretaceous genus of Enaliosaurs or sea-lizards, so called by Professor Owen from the many-ridged or folded character of the enamel of their teeth, which were the parts first known and described. Portions of the cranium, ribs, vertebrae, &c., have since been discovered, all proving the existence of a huge carnivorous saurian having affinities to the Plesiosauroid type.

Polythalamia (Gr. *polys*, many, and *thalamos*, a chamber).—An order of compound Protozoa, so called from their being enclosed in calcareous shells

consisting of a series of distinct chambers. These chambers in some species communicate with each other ; in others they are completely closed up, and appear to be the abode of a separate and probably independent animal. The general belief, however, is, that the several cells or portions of the vitalised mass communicate in some way or other with each other, so as to maintain the simultaneous vitality of the whole. In some instances each chamber of the common shell presents only a single *external* opening ; but as a general rule the substance of the shell is pierced like a sieve, with numerous minute pores or *foramina* for the protrusion of delicate filaments ; hence the term FORAMINIFERA. All the Polythalamia are marine, and frequently occur in such numbers that the fine calcareous sand of the sea-shore and sea-bottom is entirely made up of their microscopic shells. In former ages they appear to have been even more abundant ; and thus the Chalk, as well as many of the marls and limestones of the Tertiary epoch, are in a great measure composed of their remains—partly entire, and partly worn and broken by the action of the waves. As an order, the Polythalamia have been divided into several families, characterised by the arrangement of the chambers constituting the compound shell ; and nearly two thousand species have been enumerated—a number that, in all likelihood, will be greatly reduced, as more minute investigation shows that many of these so-called species are only forms of the same animal in various stages of development. **Polythalamous.**—Having many chambers or cells.

Polyzoa (Gr. *polys*, many ; *zoa*, animals).—This term embraces all the minute mollusca which inhabit compound phytoid structures like the *fustra* and *retepora*, and which were till lately confounded with the polypes or corallines. The term was introduced by Mr J. V. Thompson in 1830, and is now generally adopted in preference to *Bryozoa*, the name subsequently employed by Ehrenberg. "The Polyzoa," says Professor Allman in his monograph on the fresh-water genera, "are chiefly inhabitants of the sea, where they may be witnessed under numerous plant-like guises ; now spreading like a lichen over submerged stones or old shells, or broad fronds of laminaria and other sea-weeds ; now forming soft, irregular, fungus-like masses, or hard calcareous branchy growths, like diminutive trees ; and now again presenting the appearance of the most delicate and exquisitely-formed sea-weed or moss, offering even to the unassisted eye, in the endless repetition of the same element of form, objects of surpassing symmetry and beauty. The Polyzoa, however, are not by any means exclusively confined to the ocean ; and though by far the greater number are marine, yet in the still and running waters of the land—in the broad river and rushing stream—in the pure cold mountain lake, and the stagnant waters of the mossy fen—species are to be found, which in interest yield not one jot to their brethren of the sea, and offer to the naturalist an inexhaustible source of gratification, in the beauty of their forms and the wonders of their organisation." They are found fossil as well as recent, and occur in all formations from the Cambrian and Silurian upwards—e.g., *Oldhamia*, *fenestella*, *retepora*, *eschara*, *fustra*, &c. To distinguish the inhabitant of the polyzoan cell from the true polype, the term *polypide* has been proposed ; and the entire structure is known as the *Cænæcium* or "common dwelling," in contradistinction to the polypary or polypidom of the polype.

Ponant (Lat.).—Laying aside ; the twelfth of the fifteen series into which

Professor Rogers subdivides the Paleozoic strata of the Appalachian chain—the “Sunset” of the North American Paleozoics, and the equivalents of our Upper or true Old Red Sandstone.—See PALÆOZOIC FORMATIONS.

Pontine Marshes.—These sea-fens, so well known and dreaded by the inhabitants of Rome and the delta of the Tiber, are occasioned, according to Admiral Smyth, by the quantity of water carried into the plain by innumerable streams that rise at the foot of the mountains to the east of Rome, which, for want of sufficient declivity, creep sluggishly over the level space, and sometimes stagnate in pools, or lose themselves in the sands. Here, fermenting with decayed vegetable matter, and acted on by a fervid climate, malaria is produced—that invisible enemy that poisons the fairest portions of Italy, otherwise so salubrious, and renders man a sufferer from his cradle to his early grave. There is every appearance that the basin of these marshes was once a gulf of the sea, which has been gradually filled up by alluvium from the mountains.—See MAREMME.

Porcelainised.—Baked like potter’s clay; applied to clays, shales, and other stratified rocks that have been hardened and altered by igneous contact so as to resemble in texture porcelain or kiln-baked clay.

Porcellanite.—Known also as “porcelain jasper” and “burnt earth.” The term applied to clays and shales that have been converted by subterranean heat into jaspery or porcelain-like masses of various colours and hardness, according to their original composition, and the degree of heat to which they have been subjected. Frequent in the vicinity of dykes and erupted traps.

Porifera.—In modern systems of zoology, the second class of Protozoa, including the sponges; and so called from the masses formed by these creatures being perforated in every part with minute orifices. Literally “pore-bearing.” Sponge, as we usually see it, consists of a congeries of horny filaments, interlacing in every direction, so as to form an intricate network of intercommunicating cells; and imbedded in these filaments, in the most of sponges, are needle-shaped particles of siliceous or calcareous matter termed *spicula*. The animated portion is a mere mucilaginous investment composed of an aggregation of cells. Fossil sponges occur in several formations, and especially in the Chalk of England.

Porphyritic.—Having the aspect or texture of porphyry; as the “porphyritic granite” of Devon and Cornwall, which contains large prismatic crystals of felspar; the “porphyritic gneiss” of Portsoy, which imbeds in its folia large irregular crystals of felspar; or “porphyritic greenstone,” which has often large crystals of hornblende scattered confusedly through its mass.

Porphyr (Gr. *porphyreos*, purple).—This term was originally applied to a reddish igneous rock found in Upper Egypt, and used for sculptural purposes; a red syenitic porphyry. It is now employed by geologists to denote any rock (whatever its colour) which contains imbedded crystals distinct from the main mass or matrix, though, strictly speaking, it ought to be restricted to those having a felspathic basis. We have thus felspar porphyry, claystone porphyry, porphyritic granite, and porphyritic greenstone.

Portage (Fr.)—Applied by voyageurs to the space or watershed that lies between the navigable branches of rivers belonging to the same or different hydrographic basins, and so called from the circumstance that boats and goods have to be carried from the one branch to the other. The name

is also given to those parts where, in order to avoid cataracts or dangerous rapids, the boats are unloaded, taken out of the water, carried above the obstruction, and again launched and loaded.

Portland Cement.—A well-known cement, largely used for facing-up brick buildings, &c., in imitation of stone. It is made from carbonate of lime (common limestone) mixed with great care, in definite proportions, with the muddy deposits of rivers running over clay and chalk. The whole of the materials are carefully pounded together under water, and are afterwards dried and calcined.—See CEMENTS.

Portland Stone and Portland Sand.—A well-known group of the Upper Oolite as developed in the south of England. It consists of shelly free-stones of variable texture underlaid by thick beds of sand, and derives its name from the Isle of Portland in Dorsetshire, where certain of the free-stones have for centuries been largely quarried for architectural purposes. The Portland beds abound in fossil shells, bones of saurians, and drift coniferous wood.—See OOLITIC FORMATION.

Post- (Lat.)—A frequent prefix in scientific compounds signifying *after*, either in regard to time or position; as *post-meridian*, after mid-day; *post-tertiary*, later or younger than the Tertiary formation; *post-abdominal*, placed immediately behind the abdomen; after-abdominal. Also a quarryman's and miner's term for any thick compact stratum of sandstone or limestone; hence such phraseology as "16 feet of sandstone-post," &c.

Post-Meridian (Lat.)—After mid-day; afternoon; the ninth of the fifteen series into which Professor Rogers subdivides the Palæozoic strata of the Appalachian chain—the "Afternoon" of the North American Palæozoics, and the equivalent, in part, of our Lower Devonians.—See PALÆOZOIC FORMATIONS.

Post-Tertiary System.—Under the term *Post-Tertiary* or *Quaternary*, it is usual to arrange all accumulations and deposits that have been formed since the close of the Boulder-Drift or Glacial period—regarding that epoch as the true termination of the Tertiary system. However difficult it may be to account for the conditions that give rise to the "Drift," there can be no doubt regarding the agencies which have been at work ever since in silting up lakes and estuaries, forming peat-mosses and coral-reefs, and laying down beaches of sand and gravel. At the close of the Pleistocene period, the present distribution of sea and land seems to have been established—at least in the northern hemisphere—the land presenting the same surface configuration, and the sea the same coast-line, with the exception of such modifications as have since been produced by atmospheric, aqueous, and other obvious causes. At the close of that period the earth also appears to have been peopled by its present flora and fauna, with the exception of some local removals of certain animals, and the general extinction of a few species, whose remains are found imbedded in a partially petrified or *sub-fossil* state in Post-tertiary accumulations. We are thus introduced to the existing order of things; and though our observations may extend over a period of many thousand years, yet every phenomenon is fresh and recent compared with those of the preceding epochs. With the exception of volcanic lavas, deposits from calcareous and siliceous springs, some consolidated sands and old coral-reefs, we have now no solid strata—the generality of Post-tertiary accumulations being clays, silts, sands, gravels, and peat-mosses. Arranging these in chronological order, it is usual to speak of them as *Post-Glacial*, *Pre-Historical*, and *Historical*—the full imports of

which will be readily understood by referring to the preliminary tabulation of "CONTEMPORARY OR EQUIVALENT DEPOSITS."

Potamophyllites.—Literally "river-leaves" (Gr. *potamos*, river, and *phyllos*, leaf); a genus of monocotyledonous leaves occurring in fresh-water Tertiaries; now ranked under the more general term **PHYLLITES**.

Potato-Stones.—A quarryman's term for the *geodes* of the mineralogist; rounded irregular concretions of various composition, often hollow and lined with crystals, or containing earthy detached nuclei.

Poteriocrinus, Poteriocrinites (Gr. *poterion*, a goblet, and *enocrinus*).—An extensive genus of encrinite occurring in the Carboniferous Limestones of Britain and Ireland; and so called from the vase or goblet shape of its body or receptacle, which is composed of three series of angular plates—five in each series.

Potstone.—A soft magnesian or talcose rock, of a greenish-grey, or leek-green colour, sectile, and capable of being fashioned into pots and vases; the *lapis ollaris* of the ancients. Mineralogically, it is an uncertain mixture of talc, chlorite, mica, asbestos, and the like, occurring in beds among the crystalline rocks of various countries; in other words, coarse granular varieties of steatite or soapstone.

Pozzuolana, Pozzolána (From Pozzuoli in the Bay of Naples).—A volcanic ash or sand largely used in the manufacture of Roman cement. The artificial mixture consists of fine volcanic powder, charged with about 20 per cent of oxide of iron, and the addition of a little lime. It forms one of the best of our hydraulic cements, setting and solidifying rapidly under water.

Prairies.—The open, slightly undulating, and grassy plains of North America. Situated in the Great Central Plain, the prairies are of vast extent; some are rolling, others are flat, and level in surface; many of them are treeless, and covered only with luxuriant grass and flowers; towards the south some tracts verge into a shrubby woodland; while in the extreme north the soil is largely swampy and desert.

Precession of the Equinoxes.—"The earth's axis," says Mr Hopkins, in treating of this subject, "is at present directed to a point in the heavens near to the star *Polaris*. This point is the exact north pole of the heavens; and in considering it with reference to periods of time not exceeding many years, we usually speak of it as a *fixed point*. This, however, is not strictly correct. The pole moves very slowly, so as to describe very nearly what is called a *small circle* in the heavens. This small circle, and the motion of the pole along it, are such, that in 12,000 or 13,000 years the pole will be distant from the present pole by more than 40°; but, in some 25,000 years, it will have returned to the point in the heavens which it now occupies. Thus we see that the present distinction enjoyed by *Polaris* is but a transitory one, which in a few centuries will pass away, with the certainty, however, of returning after the period just mentioned. A further reference to the celestial globe will immediately show that this motion of the earth's axis or pole will necessarily superinduce a corresponding motion of the equinoxes along the ecliptic. This motion is about 50" a-year, and is in a direction opposite to that in which the signs of the zodiac are reckoned; and consequently the sun, after leaving either equinox, returns to it again in less time (by about twenty minutes) than if the equinox had remained stationary. This is the *precession of the equinoxes*."

Precious.—A term in frequent use among jewellers and lapidaries to express the finer varieties of minerals and gems, as "precious beryl," "precious garnet," "precious opal," and the like. Employed much in the same way as the term *Oriental*, which see.

Precipitate (Lat. *præcipito*, I cast headlong).—When substances held in solution are made to combine chemically, or are otherwise changed, so as to fall to the bottom in a solid state, they are said to be *precipitated*, or to form *precipitates*. Substances in mechanical suspension merely, and falling to the bottom by their own gravity, are, on the contrary, said to form *sediments*.

Prehnite (after Colonel Prehn, by whom it was first brought to Europe from the Cape of Good Hope).—A silicate of alumina and lime occurring largely in trap rocks, in closely aggregated prismatic crystals, and also massive, of a greenish-white or yellowish-green colour, translucent, with a vitreous lustre, brittle, and pyro-electric. Composition 44.41 silica, 24.55 alumina, 26.74 lime, 4.30 water, and traces of protoxides of iron and manganese.

Pre-Meridian (Lat.)—Immediately before mid-day; the seventh of the fifteen series into which Professor Rogers subdivides the Palæozoic strata of the Appalachian chain; the "Forenoon" of the North American Palæozoics, and the equivalent apparently of our Upper Silurians.—See PALÆOZOIC FORMATIONS.

Preternatural (Lat. *præter*, beyond).—Beyond what is natural; different from what we regard as natural; irregular; extraordinary. In the physical world, *preternatural* events are those deemed beyond or without the ordinary course of things, and yet not regarded as miraculous; while *supernatural*, on the other hand, are regarded as altogether beyond physical laws, and miraculous or ascribable to the direct intervention of creative power.

Primal (Lat.)—The first or earliest; the lowest of the fifteen series into which Professor Rogers subdivides the Palæozoic rocks of the Appalachian chain; the "Dawn" of the North American Palæozoics, and the equivalent, perhaps, of our lowest Cambrians.—See PALÆOZOIC FORMATIONS.

Primitive or Primary Rocks (Lat. *primus*, first).—Under this term the earlier geologists included all the crystalline deep-seated rocks (granite, gneiss, mica-schist, clay-slate, &c.), as having been formed in the "primeval" ocean, or contemporaneously with the globe itself, and before the creation of Life, as none of them enclose the remains of plants or animals. As general designations for the older rocks, the words *primary* and *primitive* are still retained, though it is now well known that granite and crystalline strata are found of all ages and in all formations. The term may be regarded as synonymous with the *Azoic*, *Hypozoic*, *Metamorphic*, or *Non-fossiliferous* systems of modern geologists.

Primordial (Lat. *primus*, first; *ordo*, an order).—A term used by M. Barrande for the lowest or earliest zone of fossiliferous strata, more especially as developed in Bohemia, the field of his principal labours. May be regarded as the equivalent of the *Cambrian system* of Professor Sedgwick.

Pristacanthus (Gr. *pristis*, a saw, and *akantha*, spine).—Literally "saw-spine;" a genus of ichthyodorulites or fin-spines found in the Oolite, and supposed to belong to fishes of the Cestraciont family.

Pristis (Gr.)—The saw-fish; a well-known predatory fish allied to the Rays and Sharks, and remarkable for its long, flat, bony beak, which is

armed on either side (like a saw) with sharp compressed teeth, the whole constituting a most formidable weapon, offensive or defensive. The beaks or "saws" of extinct species occur in the Tertiary beds of England and the Continent.

Producta, Productus (Lat., produced, drawn out).—A well-known genus of brachiopodous molluscs, occurring abundantly in Devonian, Carboniferous, and Permian strata, and so termed from one valve of the shell being in most of the species prolonged beyond the other, and often to a great extent. The *Producta* has been taken as the type of the family *Productidae*, in which the shell is concavo-convex, with a straight hinge-line, valves rarely articulated by teeth, closely appressed, furnished with tubular spines; ventral valve boldly convex; dorsal concave; internal surface dotted with conspicuous punctures: *dorsal* valve with a prominent cardinal process; brachial processes sub-central; vascular markings lateral, broad, and simple; adductor impressions dendritic, separated by a narrow central ridge: *ventral* valve with a slightly notched hinge-line; adductor scar central, near the umbo; cardinal impressions lateral, striated. The *Productidae* are highly characteristic of the Carboniferous Limestone, occurring in many species, and in all stages of growth and aggregation; hence the frequent term "*Productus* Limestone."

Prognathous (Gr. *pro*, forward, and *gnathos*, the jaw-bone).—Prominent or projecting-jawed; e.g., the prognathous skull of the negro, in which the jaws project considerably beyond the vertical facial line.

Protoponiscus (Gr. *protopon*, a face or mask, and *oniskos*, wood-louse).—A Permian crustacean, apparently belonging to the family of Isopods, and found in the Zechsteins of Germany and magnesian limestones of Durham. So named by J. W. Kirkby, who objects to Schaueroth's term "*Palæocrangon*," as not expressing the true affinities of the species.

Prototista (Gr. *protos*, first, and *tista*, created beings).—A term proposed to embrace the protophytes and protozoans, or those minute organisms which seem to stand on the confines of the vegetable and animal kingdoms, and in some instances are but doubtfully referable to either.

Protogine (Gr. *protos*, first, and *ginomai*, I am formed).—The French term for a granite composed of felspar, quartz, and talc; *talcose granite*. It abounds in the Alps, in Cornwall, and other countries, and derives its name from the erroneous idea that it is the oldest or *first-formed* of the granites. The *Kaolin* or China-clay of Cornwall is chiefly derived from its decomposition.

Protophyta (Gr. *protos*, first, and *phyton*, a plant).—Literally "first or earliest plants;" a term applied to the diatoms and other microscopic organisms which apparently belong to the vegetable kingdom, in contradistinction to *Protozoa*, which embraces those appertaining to the animal.—See PROTOZOA.

Protornis (Gr. *protos*, first, and *ornis*, bird).—Literally "first bird;" the most ancient example as yet known of a passerine fossil bird. It occurs in the Eocene Tertiaries of Glaris, is about the size of a lark, and in some respects similar to that bird.

Prototaxites (Gr. *protos*, first, and *taxus*, yew-tree).—A genus of woody trunks with concentric rings of growth and medullary rays, occurring in the Devonian strata of Canada, and so named by Dr Dawson from their having the spirally-marked cells characteristic of the genera *taxites* and *spiropitys*, but differing from any known conifer in the cylindrical form

and loose aggregation of the wood-cells. Many of the trunks show varieties in the growth rings, which "indicate a decided difference of temperature in the seasons of the Devonian year."

Protosaurus, Protosaurus (Gr. *proteros*, earlier, the first, and *saurus*, lizard).—"The fossil monitor of Thuringia;" so called from its occurring in the bituminous copper-slate of Thuringia, and for a long time the earliest reptile known to geologists; hence the term *Protosaurus*.

Prototype (Gr. *protos*, first, and *typos*, a type or mould).—The original form after which others are fashioned or moulded; the original from which others are copied; the primary form to which others, in their principal features or characteristics, bear resemblance. Often loosely and variously applied.

Protovirgularia (Gr. *protos*, first, the most ancient, and *virgularia*).—A genus or group of graptolites occurring in the Lower Silurian strata, and so named by McCoy from the resemblance of their opposite and distant cells to those of the existing *virgularia*.

Protozoa (Gr. *protos*, first, and *zoe*, life).—In modern systems of classification, the first or lowest division of the animal kingdom. It includes a number of creatures of a very lowly type of organisation, which appear almost to occupy a sort of neutral ground between animals and vegetables—the function of reproduction being principally performed by a plant-like budding or division of the parental substance. The bodies of the Protozoa consist either of a simple elementary cell, or of an aggregation of cells, each cell being capable of a separate and independent existence. Some are simply gelatinous; others secrete a horny, calcareous, or siliceous investment; and most of them are of microscopic size. The Division embraces three classes:—1. The *Rhizopoda*, whose organs of locomotion consist of mere root-like expansions of the body itself; 2. The *Porifera*, or sponges; and, 3. The *Infusoria*, or infusory animalcules: or, more minutely, according to other systematists,—1. *Rhizopoda*; 2. *Polycystina*; 3. *Spongida*; 4. *Thalassicolrida*; 5. *Gregarinida*; and, 6. *Infusoria*.—See the respective classes.

Protozoic (Gr. *protos*, first, and *zoe*, life).—First-life; belonging to, or containing, the first traces of life. Applied to the earlier fossiliferous epoch and strata; equivalent to Primordial; hence such phrases as "protozoic zone," "protozoic world," &c.

Psammite (Gr. *psammos*, sand).—A term in common use among Continental geologists for fine-grained, fissile, clayey sandstones, in contradistinction to those which are more siliceous and gritty (*grès*).

Psammodus (Gr. *psammos*, sand, and *odous*, tooth).—Literally "sand-tooth;" a provisional genus of ostracodont teeth from the Carboniferous Limestone, and so called from their granular or rough upper surface, used for crushing and grinding. They are generally of a quadrangular form, and of large dimensions.

Psarolites, Psaronites (Gr. *psaros*, speckled, and *lithos*).—The name given to the silicified stems of Tree-ferns found so abundantly in the New Red Sandstone (Permian) near Hillersdorf in Saxony, in allusion to the stellated markings produced by sections of the vessels that compose the tissues. From this speckled appearance, which is visible to the naked eye, these fossils have also obtained the popular name of *Staarlein-stein* or *Starstone*. *Psaronites* also occur in the Upper Coal-measures of France, United States, &c.; and, like the existing tree-ferns of New Zealand, their trunks

are surrounded by a dense mass of air-roots which adds greatly to their dimensions.

Pseudo- (Gr. *pseudes*, false).—A prefix of frequent occurrence in scientific compounds, and implying something deceptive in appearance, function, or relation; as *Pseudopods*, those protozoans which have the power of thrusting out the fleshy substance of their bodies into foot-like organs or processes (literally "false-feet"); *Pseudocarps*, *Pseudobulbs*, and the like.

Pseudomorphous (Gr. *pseudes*, false, and *morphe*, form).—Applied to substances which, not possessing a crystalline structure, are yet found in the form of regular crystals. Such *pseudomorphic crystals*, as they are termed, are evidently moulded in cavities from which original regular crystals have been dissolved—the new substances, particle by particle, taking their place. Blum divides pseudomorphs into two classes, which embraces respectively two and three sub-classes, viz. :—

1. Alteration pseudomorphs, produced either—
 - a, by removal of constituents;
 - b, by addition of constituents; or,
 - c, by exchange of constituents.
2. Displacement pseudomorphs, produced either—
 - a, by incrustation; or,
 - b, by replacement.

According to Bischoff, the whole phenomena of pseudomorphism can be explained by chemical agency in the wet way without calling in (as some have done) the presence of igneous agency.

Pseudopodia (Gr. *pseudes*, false, and *pous*, *podos*, foot).—Literally "false feet;" the term applied to those filiform processes by which protozoans, like the *Amoeba*, effect their progression, and which are merely prolongations of the sarcode or gelatinous substance of the body thrust out and retracted at will by the animalcule.

Pseudomelane (Gr. *pseudon*, smooth, and *melan*, black).—Uncleable manganese ore; a mixture of the protoxide and hyperoxide of manganese, with impurities of baryta, silica, potash, and water. It usually occurs in botryoidal, kidney-shaped, or stalactitic masses, having a smooth surface, foliated texture, and dark glistening colour; whence the name. It is generally found along with other ores of manganese in veins in the older or crystalline rocks.

Psilophyton (Gr. *pseudon*, smooth, and *phyton*, stem).—A genus of Lycopodiaceous plants described by Dr Dawson as occurring abundantly in all the members of the Devonian series in Canada and the state of New York. Psilophyton branches dichotomously, is covered with closely appressed minute leaves; the stems springing from a rhizome having circular areoles, sending forth cylindrical rootlets. Some of the under-clays in Gaspé are filled with these vertical rootlets, just as the fire-clays of the Coal-measures are with those of stigmara.

Pterichthys (Gr. *pteron*, wing, and *ichthys*, fish).—Literally "winged fish;" a characteristic bone-encased fish of the Old Red Sandstone, deriving its name from two wing-like lateral appendages, which seem to have been used both as organs of motion and defence. Like the living *Ostracion* or trunk-fish, the *Pterichthys* was encased in a framework of bony plates, leaving only the caudal portion free, and this seems to have

been covered with rounded enamelled scales, and furnished with a vertical sailing-fin. The osteology and organs of the *Pterichthys* are yet but imperfectly known.

Pterinea (Gr. *pteron*, a wing).—A sub-generic form of the *Avicula* or wing-shell, occurring in Palæozoic strata, and characterised by their thick, rather inequivalve, very oblique, and broad-winged shells, which have the beaks anterior, sinus shallow, and hinge-area long, straight, narrow, and striated lengthwise.

Pterodactyle (Gr. *pteron*, wing, and *daktylos*, finger).—Literally "winged finger;" a genus of flying reptiles, several species of which have been discovered in the Lias, Oolite, Wealden, and Chalk formations of Europe. "With a long-snouted head and long neck," says Mantell, "much resembling that of a bird, bat-like wings, and a small trunk and tail, with lacertian affinities in its skull, teeth, and skeleton, and with a bird-like structure of sternum and scapular arch, these creatures present an anomaly of structure as unlike their fossil contemporaries as the duck-billed ornithorhynchus of Australia to existing mammals. The cranium is small; the jaws are long, and either armed with numerous sharp-pointed teeth, or toothless like those of a bird. The eye-orbit is very large; the sclerotica consists of a ring of bony plates, and the nostrils are placed near the orbits. The cervical vertebræ are large and strong, and capable of great flexibility backwards and forwards, probably to allow the head to fall back to the centre of gravity during flight. The dorsal vertebræ are from seventeen to twenty in number. The sacrum is formed by the coalescence of two vertebræ only, as in existing reptiles, and not of many, as in birds and certain extinct saurians. The tail is generally short, an unusual character with saurians; but a species with a long tail occurs at Solenhofen. There are five toes or digits on each foot; the outer finger of the fore-arm is immensely elongated for the support of a membranous expansion (the impression of which is preserved in some instances); and the other digits of fore and hind feet terminated in long curved claws. The size and form of the extremities show that the *Pterodactylus* was capable of perching on trees, of hanging against perpendicular surfaces, and of standing firmly on the ground, when, with its wings folded, it might crawl on all fours, or hop like a bird." Restorations of the pterodactyle have been attempted by Mr Hawkins at the Crystal Palace; and ample details are given by Dr Buckland ('Bridgewater Treatise'); by Owen ('Monograph Palæontogr. Soc.'); by Von Meyer ('Palæontographica'); and by other authorities.

Pterophyllum (Gr. *pteron*, a wing, and *phyllon*, leaf).—Literally "wing-leaf;" a genus of cycadaceous leaves, chiefly from the Lias and Oolite. Like ferns, they are pinnated, but are readily distinguished by their greater substance, thicker midrib, and especially by their veins being in all cases undivided; that is, never forking or dichotomising as in ferns.—See CYCADITES.

Pteropoda (Gr. *pteron*, a wing or fin, and *pous, podos*, a foot).—Literally "wing or fin-footed;" a class of encephalous molluscs, consisting of small floating marine animals like the *clio* and *hyalæa*, that swim by the alternate expansion and contraction of two lateral appendages, whence the name. Their inversely-pyramidal, transversely-striated, fragile shells, occur in all formations—e.g., *theca*, *pterotheca*, *conularia*, &c.

Pterosauria (Gr. *pteron*, wing, and *sauros*, lizard).—Literally "winged lizards;" a group or order of extinct saurians, organised, as the name im-

plies, for an aerial existence, and embracing such forms as *Pterodactylus*, *Ramphorhynchus*, &c. In the Pterosaurs, the whole osseous system, according to Owen, is modified in accordance with the possession of wings—the bones being light and hollow, and most of them permeated by air-cells, with thin, compact, outer walls. The modification of the pectoral limbs for flight is due to an elongation of the fore-finger; the other fingers being of the ordinary length, and terminated by claws. On this elongated finger the membranous skin was expanded as in the bats; and, as in the bats, a small pelvis and weak hind limbs bespeak a creature unable to stand and walk like a bird, but merely capable of dragging its body along. The scapula and coracoid are long and narrow, but strong; the vertebræ of the neck are few, but large for the support of a large head with long jaws, armed with sharp-pointed teeth; the skull was lightened by large vacuities between the nostrils and the orbit. The Pterosaurs range from the Lias to the Chalk inclusive; and specimens have been found ranging from one to twenty feet in expanse of wing.—See tabulations, "ANIMAL SCHEME."

Pterygótus (Gr. *pteron*, wing, and *otos*, ear).—A gigantic crustacean, belonging to the fossil family *Eurypterida*, and occurring chiefly in the "passage beds" between the Silurian and Devonian systems. It receives its name from the peculiar shape of its detached mandibular or jaw-feet, which from their scale-like sculpture were at first mistaken by Agassiz for the remains of some fish. As yet the species of *Pterygotus* have been found only in the lower flagstones or tilestones of the Old Red in Forfar and Hereford shires, and in the Upper Silurians of Lesmahagow and Ludlow—strata which, for this marked characteristic, may not unappropriately be termed the "*Pterygotus* beds" of Great Britain. In general aspect the *Pterygotus* may be described as a gigantic "lobster-like crustacean," inasmuch as it has an elongated form, composed in the main of a cephalo-thorax, an abdominal portion consisting of several segments, and a telson or tail-plate. This, however, is the utmost of the similitude, the genus, like the family, partaking of characters which appertain to several existing orders—Copepoda, Pœcilipoda, and others. Thus, taking *Pterygotus* in its *dorsal aspect*, we are presented with a somewhat oblong cephalo-thorax or carapace having two large compound eyes placed on the anterior margin; an abdominal region or main portion consisting of eleven segments, which gradually swell out in width till the fifth or sixth, and then gradually narrow and elongate towards the tail; and a telson or tail-plate somewhat oval, and tapering to a point like a Roman spear-head. In the *abdominal aspect* the tail and all the segments (twelve in number) are void of limbs or other appendages; and the organs of motion are all attached to the under-side of the carapace, as in the *Limulus* or King-crab. There are three or four pairs of such limbs—the first five-jointed, long, chelate, and pincered like those of the lobster; the second pair also five or six jointed, and simply pointed; and the third pair broad, and terminating in a palette-like paddle for oaring or swimming. The oral apparatus consists, as in the King-crab, of the serrated basal-joints of these limbs, the whole being protected by a heart-shaped breast-piece or metastome. The vent and genital apparatus are placed forward on the first and second under-segments, which separate into several pieces—the separation being protected by a duck-bill-like plate, which differs in shape in the different sexes. The whole exterior surface of the crust, which seems to have been calcareo-coriaceous rather than hard-calcareous, is ornamented by a

peculiar scale-like sculpture, which becomes beaded and serrated on the free margins, whether in the carapace, abdomen, or telson.—See EURYPTERIDE.

Ptilodictyon (Gr. *ptilon*, a plume or feather, and *didyon*, a net).—Literally “feather-net;” a genus of Silurian polyzoans apparently allied to the living *Eschara* of our coasts, and so termed from its flat, branching, feather-like aspect.

Ptilopóra (Gr. *ptilon*, a plume, and *póra*).—Literally “feather-pore;” a genus of Carboniferous polyzoans, whose pores or cells are arranged in feather-like form on a common axis—the whole having the appearance of a plume or feather of network.

Ptychóceras, Ptychoceratite (Gr. *ptyche*, a fold).—A genus of chambered shells of the Ammonite family, peculiar to the Cretaceous formation, and so named from the shell, which is bent or folded upon itself, the two straight portions being in contact.

Ptychodus (Gr. *ptyche*, a fold or wrinkle, and *odous*, tooth).—Literally “wrinkle-tooth;” a genus of Cestracient fish-teeth, found in almost every chalk-pit, and occasionally in conjunction with fin-spines, which are striated, recurved, serrated on the posterior margin, and evidently the defensive armature of the same fish.

Ptychognáthus (Gr. *ptyche*, a ridge, and *gnathos*, jaw).—Literally “ridge-jaw;” a sub-genus of dicynodont reptiles from the supposed Triassic sandstones of Rhenosterberg, South Africa; and so termed from the prominently-ridged sockets of the canine tusks so peculiar to the *Dicynodont* family, which see.

Ptychólepis (Gr. *ptyche*, a fold or wrinkle, and *lepis*, a scale).—Literally “wrinkle-scale;” a genus of sauroid fishes, of which several species occur in the Lias of England.

Pudding-Stones.—Now used as synonymous with *conglomerate*, but originally applied to a mass of flint pebbles, cemented by a siliceous paste, from the resemblance of the imbedded pebbles to the fruit in a plum-pudding. The *plumpudding-stone* of Herefordshire, so often sliced and polished by lapidaries, is composed of black-flint pebbles imbedded in a light-coloured paste; hence the appropriateness of the name.

Pulley-Stones.—A familiar term for the hollow casts or moulds of the joints and stems of encrinites, as they occur in the cherts and rottenstones of the Carboniferous formation. Originally enclosed in the siliceous matrix of chert, the calcareous stems of the crinoids have been subsequently dissolved, thus leaving their “screw-like” or “pulley-like” cast.—See ENCRINITE.

Pulverise (Lat. *pulvis*, *pulveris*, dust).—To reduce to dust or powder; to crumble. Soil and rocks crumbled down by aqueous or atmospheric agency are said to be *pulverised*.

Pumice (Ital. *pomice*, akin to *spuma*, froth).—Volcanic froth or scum; a light spongy lava, so porous, vesicular, and fibrous, as to float on water. It is usually of a whitish-grey colour, with a sub-pearly lustre, and consists of about 75 silica and 17 alumina, with varying percentages of soda, potash, and water. Used largely both in its natural and powdered state as a polishing material.

Pumiceous.—Having the nature and appearance of pumice; composed of pumice.

Pumiciform.—In the form of or resembling pumice. Applied to light,

porous rock-products, which seem, in some way or other, to be the results of igneous action.

Pupa.—The chrysalis shell ; a genus of small land-snails found all over the world, but most abundantly perhaps in the northern hemisphere. Upwards of forty species (fossil and sub-fossil) have been obtained from Tertiary strata ; and one species, *P. venusta*, from the Lower Coal-measures of Nova Scotia.

Purbeck Beds.—The uppermost members of the Oolite proper, or, according to others, the basis of the Wealden formation. They derive their name from the island or peninsula of Purbeck, on the coast of Dorsetshire, where they are typically displayed ; and consist of argillaceous and calcareous shales, and fresh-water limestones and marbles. They are noted for their layers of fossil vegetable earth (dirt-beds), enclosing roots, trunks, and branches of cycads and conifers.

Pustulopora (Lat.)—Literally “pustule-pore ;” a common tubular-branched coral of the Chalk formation. The tubes are cylindrical ; their apertures are arranged in spiral rows, and slightly projecting, thus giving a pustulous appearance to the stem and branches.

Puy (Fr.)—A provincial term for the conical hill-tops of Auvergne, in Central France, which are for the most part the craters of extinct volcanoes, as Puy de Dome, Puy de Come, &c.

Pycnodonts, Pycnodontides (Gr. *pyknos*, thick, and *odontos*, tooth).—Literally “thick-tooth ;” an extensive family of fishes, occurring in Mesozoic strata. Their leading character consists in having the mouth provided with a dense pavement of thick, round, and flat teeth, for the purpose of crushing the shells and crustacea on which they fed.

Pygocéphalus (Gr. *pygos*, thick, solid, and *kephale*, head).—A minute stalk-eyed crustacean from the Coal-measures of Lancashire and Lanarkshire, described by Mr Huxley in vols. xiii. and xviii. of ‘Geolog. Journal.’

Pygopterus (Gr. *pyge*, the rump, and *pteron*, a fin).—Literally “rump-finned ;” a genus of sauroid fishes (the *Palæothrissum* of Blainville) characterised by the great development of their sub-dorsal and caudal fins, and occurring throughout the Carboniferous and Permian formations.

Pyrites (Gr. *pyr*, fire, and *ites* for *lithos*).—Sulphurets or sulphides of iron, copper, cobalt, &c., are so termed, either from the hardness of iron-pyrites, which strikes fire, or from its decomposing spontaneously with a considerable evolution of heat. While we thus have “iron-pyrites,” “copper-pyrites,” “cobalt-pyrites,” &c., the term *pyrite* is restricted by mineralogists to the sulphuret of iron, which occurs in rocks of all formations, and seems to be produced either by igneous action, or more commonly from aqueous solution, especially under the influence of decomposing organic matter. It is very liable to decomposition—the sulphur sometimes separating and passing off as sulphuretted hydrogen, and the iron being changed into the hydrated peroxide ; at other times it is converted into the sulphate of iron.

Pyritiferous.—Applied to rocks containing pyrites disseminated through their mass, either in cubic crystals or in grains or irregular nodules—e.g., “pyritiferous shales,” “pyritiferous vein-stone.”

Pyrogenous (Gr. *pyr*, fire, and *ginomai*, I am formed).—Fire-formed ; produced by fire ; used as synonymous with *igneous*.

Pyrolusite (Gr. *pyr*, and *lusis*, decomposition).—The mineralogical term for the common bin oxide or black oxide of manganese, in allusion to the facil-

ity with which it is resolved by heat into oxygen and a suboxide—giving off at a red heat from 10 to 12 per cent of oxygen. It occurs in various states—massive, disseminated, fibrous, earthy, or compact; is of an iron-black or steel-grey colour; semi-metallic lustre; streak black and soiling; specific gravity from 4.7 to 5; hardness from 2 to 2.5; and consists of 63.6 manganese and 36.4 oxygen, with traces of baryta, silica, and water. "Pyrolusite was formerly confounded with *Manganite* (the grey oxide), but differs in crystallisation, and in containing no water. It is best distinguished by the colour of the streak, and its softness—often so great as to soil the fingers. It occurs chiefly in beds in gneiss, clay-slate, porphyry, and the older rocks, or in veins often with calc-spar, heavy-spar, and ores of iron and manganese. It sometimes has been produced by the decomposition of the latter; and crystals of manganite are found only partially converted into pyrolusite." As an ore, pyrolusite is worked in many places, and is employed in the manufacture of glass, in glass-painting and enamel, and in the glazing and colouring of pottery.

Pyrope (Gr. *pyr*, fire; *opsis*, appearance).—The mineralogical term for a dark-red variety of iron-garnet (precious garnet) which is usually found in rounded or angular fragments, loose or imbedded. The *carbuncle* of the lapidaries; both names having reference to the appearance of fire or burning coal which it presents when held between the eye and the sun.

Pyrophysalite (Gr. *pyr*, fire, and *physalite*).—Coarse columnar topaz; same as **PHYSALITE**, which see.

Pyroxene (Gr. *pyr*, fire, and *xenos*, a guest).—A name used by Continental mineralogists for *augite* (which see), in allusion to its usual mode of occurrence in the igneous rocks.

Pyrrhotine (Gr. *pyrrhotes*, reddish).—A sulphide or sulphuret of iron generally occurring massive and amorphous, having a granular structure, and of a reddish or light bronze-yellow colour. Distinguished from common iron pyrites by its inferior hardness.

Pyxidiculum (Lat., a small box).—A genus of Diatoms, whose minute siliceous shields present the appearance of a saucer-shaped box; whence the name. Abound in existing waters, and in recent and Tertiary marls or microphytal earths.

Q

Quadersandstein (Ger.).—Literally square-stone or freestone; the German term for certain soft sandstones of the Chalk formation—the *Lower Quadersandstein* being apparently the equivalent of our Upper Greensand, and the *Upper* being nearly in the same horizon as our Upper White Chalk.—See tabulations, "GEOLOGICAL SCHEME."

Quadr-, Quadri-, Quadru- (Lat. *quatuor*, four).—A frequent prefix in scientific compounds signifying *four*, or *in fours*; as *quadrangle*, a figure having four angles, and consequently four sides; *quadrilateral*, four-sided; *quadruped*, an animal having four feet—four-footed; *quadriceps*, furnished with four horns or antennæ; *quadripartite*, divided into four parts, or arranged in fours, &c.

QUA

Quadrúmana (Lat. *quatuor*, four, and *manus*, hand).—Literally “four-handed;” a term applied to the monkeys and lemurs, as forming an order distinct from the *bímana* or two-handed mankind. Though termed “four-handed,” and furnished with a more or less opposable thumb to each extremity, these animals walk on all-fours—man with his perfectly opposable thumb being in reality the only “handed” animal in creation. *Quadrumanous* remains have been found in the lowest Eocene Tertiaries, if not in the Upper Chalk formation.

Quagmire or **Quakemire**.—Boggy or miry ground so saturated with water that the surface quakes or shakes to a considerable extent under the feet of the passer over. The growing surface of these *quaking-bogs* has often considerable tenacity, but once broken, there is nothing beneath save soft “mire” or mud, and that frequently to great and dangerous depths.

Quaquavérsal (Lat. *quaque*, on every side, and *versus*, turned).—Dipping on every side; applied to strata that dip on all sides from a common centre; dome-shaped or encircling stratification.

Quarry-Water.—A familiar term among quarrymen and builders for the water which is contained in the interstices of a rock when newly raised from the quarry, but which it gradually loses by evaporation when exposed to the air. The majority of rocks, whether stratified or unstratified, are softer and more easily dressed when newly quarried, but as they lose the “quarry-water” they become harder and more refractory, this water as it evaporates apparently depositing within the minute pores the mineral matter (carbonate of lime, iron, siliceous, &c.) which it previously held in solution.

Quartz (Ger. *quarz*).—A German miner's term for crystallised silica; rock-crystal; silica is its purest rock-form. As a mineral, quartz is properly colourless, but more frequently coloured in various shades of white, grey, yellow, brown, red, blue, and even black; hence numerous varieties are distinguished by their colours—as *rock-crystal*, the highly transparent varieties; *amethyst*, the violet blue; *siderite*, the indigo or Berlin blue; *topaz*, the wine-yellow; *cairn-gorm*, brown or cinnamon-yellow; *milk-quartz*, *rose-quartz*, and so forth. *Common quartz*, occurring massive and in veins of various shades of white, is a well-known rock, and, according to its colour and lustre, is spoken of as *milk-quartz*, *glassy-quartz*, and the like; or mixed with other mineral matter it passes into *jasper*, *Lydianstone*, *hornstone*, *chert*, *flint*, *chalcedony*, *agate*, and numerous other rocks and minerals, in all of which silica constitutes more than nine-tenths of the mass. The Quartz family is usually arranged into three groups:—1. The *Vitreous*, or those varieties which have a bright glassy lustre, as rock-crystal, rose-quartz, siderite, cairngorm, amethyst, aventurine, &c.; 2. The *Chalcedonic*, or those which display the sub-vitreous or waxy lustre and the translucency of chalcedony, as agate, carnelian, chalcedony, flint, hornstone, onyx, &c.; and, 3. The *Jaspery*, or those presenting the duller colours, lustre, and opacity of jasper, as bloodstone, jasper, Lydianstone, touchstone, siliceous sinter, silicified wood, &c.

Quartziferous.—Literally, “quartz-yielding;” a term frequently but somewhat loosely made use of in geology. Thus “quartziferous veins” are those essentially composed of quartz, while “quartziferous sands and sandstones” are those in which the particles of quartz are somewhat large and readily discernible.

Quartzite.—An aggregation of quartz grains; granular quartz. The

term is generally applied to sandstones which have been indurated or altered by heat so as to assume the aspect of quartz-rock.

Quartzose.—Literally “abounding in quartz;” a term applied to sands, sandstones, and grits essentially composed of quartz, and in which the component particles are distinct and palpable.

Quartz-Rock.—A term usually, and properly, applied to a stratified rock of the metamorphic series, consisting almost entirely of silica, having a granular-crystalline texture, and of a greyish or pinkish-grey colour from the presence of a slight trace of iron.

Quaternary (Lat. *quatuor*, four).—Applied to all accumulations above the true Tertiaries; equivalent to POST-TERTIARY, which see.

Quicklime.—The well-known form of lime after any ordinary limestone (or carbonate of lime) has been exposed to a red-heat in a kiln, so as to expel its carbonic acid. It is a protoxide of calcium, and on being sprinkled with water falls readily to powder, with a crackling noise and great evolution of heat. It has obtained its name from its caustic and corroding qualities.

Quicksilver.—The familiar term for fluid mercury, in allusion to its bright metallic lustre and silver-white colour. It occurs native in rocks of all ages, chiefly with cinnabar (sulphuret of mercury) in veins and fissures; is fluid at ordinary temperatures, but congeals at -40° Fahr., and forms tesseral crystals.—See MERCURY.

Quincunx (Lat. *quinque*, five).—Strictly speaking, that arrangement of five objects in which they are made to occupy the four corners and the point of intersection of the diagonals of a square. The term, however, is generally applied to any number of objects so disposed in lines that the members of each succeeding line shall stand immediately behind the interspaces or openings in the preceding one. The leaf-scars of *lepidodendron* and the *conifera*, and the punctures of *stigmaria*, are arranged in this quincuncial order.

R

Radiária.—A term applied by Lamarck to such of the *Radiata* of Cuvier as have a *radiated form of the entire body*. They are the rayed animals proper, and include only the sea-urchins, star-fishes, and medusæ or sea-nettles.

Radiata (Lat. *radius*, a ray).—Radiated; arranged round a central axis like the rays or spokes of a wheel. In zoology, Cuvier's fourth and lowest division of the animal kingdom, including all those animals whose parts are disposed round a central axis in a radiated form, like that of the star-fish. The division embraces *Echinodermata* (star-fish, sea-urchins, &c.); *Intestina* (intestinal worms); *Acalepha* (medusæ or jelly-fish); *Polypi* (sea-anemones, coral polypes, &c.); and the INFUSORIA. Since Cuvier's time this arrangement has been somewhat modified; and the lower groups of animals which are “gobular” rather than “rayed” have been erected into an independent class under the title PROTOZOA, which includes such

orders as the Rhizopods, Sponges, and Infusoria.—See tabulations, “ANT-MAL SCHEME.”

Radiated (Lat. *radiatus*).—Adorned with rays; diverging from a common centre like the spokes of a wheel, a form frequent among minerals, as zeolite and radiated iron-pyrites; belonging to the division Radiata or rayed animals.

Radiolites.—A genus of Cretaceous bivalves belonging to the curious *Hippurite* family, and so called from the radiated structure of the outer layer of their opercular-looking upper valves. The Radiolite has an inversely conical under-valve, with a deep straight cavity, rough and foliaceous in its outer layers, and smooth within, with a finely-striated margin. It is fitted with a convex or sub-conical opercular-looking upper valve, which gives to the entire shell a somewhat spherical shape; hence the occasional synonyme of *Sphaerulite*.—See HIPPURITE.

Rag, Ragstone.—A provincial English term for any hard coarse-textured rock; as “Kentish rag,” a tough siliceo-calcareous member of the Lower Greensand, used for building purposes in Kent; “Rowley rag,” a hard crystalline greenstone, constituting Rowley Hill, near Dudley, &c.

Rain, Rainfall.—As a geological agent, rain is of prime importance—vitality as well as mechanically; its mechanical effects, however, being the most conspicuous, and that more especially in hilly regions. Every shower that falls exerts a degrading or wasting influence on rocks, soils, and all exposed surfaces. By entering the pores of rocks and soils, rain softens and loosens their cohesion, and thus renders them more easily acted on by currents of wind and water. Land-floods or freshets also arise from rains, the melting of snow, and from hail-storms; and the periodical rains of the tropics produce inundations and similar phenomena. The fall of rain varies in different countries, and of course will be attended with proportional results. In the British Islands it ranges from 24 to 60 inches, or has an average of about 36 inches; while in tropical countries the mean annual fall is upwards of 200 inches—229 inches having been noted in Dutch Guiana, 276 in Brazil, 302 at an elevation of 4200 feet in the Western Ghats, south of Bombay; and in the Khasia Mountains, at the head of the river-flats or Jheels of Bengal, upwards of 600 inches, or 50 feet, have been registered by various observers. At the same place, Dr Hooker has recorded 30 inches in twenty-four hours; 21 inches have been noted at Cayenne during the same period; and 23 inches are not uncommon near Port Jackson in New South Wales. Accustomed to the gentle rains of our own island, we can scarcely form an estimate of the changes produced by such sudden and enormous falls on the surface-soil and river-courses of tropical countries.

Rainbow Chalcedony.—A variety of chalcedony consisting of thin concentric layers, which when cut across exhibit an iridescence resembling the colours of the rainbow.

Rain-Gauge.—An instrument, of which there are several kinds, for ascertaining the amount of rainfall in any given locality. One of the simplest and most convenient is a tube sunk into the earth so as to prevent as much as possible the effect of evaporation, with a square or circular receiver for the rainfall, and a graduated float to mark the rise or amount of water within for any given period.

Rain-Prints.—Every one must have observed the effects of a passing shower on the surfaces of the half-consolidated muds and sands of our

tidal shores and estuaries—how it pits and patters them according to the size of the drops, the force with which they are borne by the wind, and the slanting direction in which they impinge. Precisely similar appearances are presented on the stratified surfaces of every formation, from the lowest Silurian up to the latest Post-tertiary—these surfaces having, when soft, received the shower-fall, been subsequently sun-baked and hardened, and then overlaid by new deposits which filled up the pits and patters as so many moulds. These fossil pittings are more or less circular, according to the vertical or slanting direction of the rainfall; are often large, as from a heavy shower; not unfrequently large and small curiously commingled; and occasionally the same surface bears traces of showers that must have fallen when it was soft and easily impressed, and of others that fell subsequently and made a fainter impression on its partially-baked crust. We have thus not only evidence of the intensity and continuance of these primeval showers, but of the quarter from whence the wind blew that drove them against the muddy flats of long-since obliterated shores and estuaries.

Rake Vein.—In mining, a rent or fissure, generally vertical or highly inclined, and cutting indifferently through all the strata. Rake veins are either simple fissures unaccompanied by any displacement of the strata, and known as “gash veins;” or accompanying a fault or dislocation, and then termed “slip veins.”

Ramphorhynchus (Gr. *ramphos*, a bird's beak, and *rhynchos*, beak or snout).—A genus of Pterosaurians or winged reptiles from the Oolites of Europe, and characterised by their horny toothless mandibles, which seem, however, to have been furnished with a pair of long prehensile teeth in the front part.

Rams' Horns.—A familiar term among the peasantry of England for the curling or incurved shell of the *Ammonites*.

Rapids.—In geography, those portions of a river-course where the current moves with much greater rapidity than the ordinary flow of the stream. When impeded with rocks, which is generally the case, rapids greatly interfere with or altogether obstruct the navigation of a river.

Raptōres (Lat. *raptor*, a seizer or snatcher).—Birds of Prey; an order of birds, so called from their habit of seizing and retaining their prey with their powerful talons. They are partly *diurnal*, as the vultures, eagles, falcons, &c., and partly *nocturnal*, as the owls. Remains of *Raptorial* birds occur in the Tertiary strata of Europe—*e.g.*, *Lithornis vulturnus*, &c.

Rasōres (Lat.).—Literally Scratchers or Scrapers; an order of birds, so called from their habit of scraping or scratching up the soil with their feet in order to obtain their food—*e.g.*, the common barn-fowl, turkey, partridge, and the like. Remains of *Rasorial* birds have been found in the bone-caves of England and Germany.

Rastrites (Lat. *raster*, a rake).—That division of Graptolites (Silurian sea-pens) having the cells placed at wide intervals along the stem or axis, and accordingly standing out bold and pointed like the teeth of a rake.—See GRAFTOLITES.

Rauchwackè (Ger. *rauch*, smoke, and *wackè*).—The German term for one of the upper members of the Permian *zechstein* or magnesian limestone, in allusion to its dark-grey colour. The *Rauchwackè* seems to be the equivalent of the upper brecciated limestones of Durham and Yorkshire.

Ravine (Lat. *ravio*, I sound hoarsely).—A deep precipitous gorge ; usually the narrow excavated channel of some mountain stream ; and so called from the hollow murmur of its waters.

Reddigar.—Known also as *red orpiment* and *red sulphuret of arsenic* ; the proto-sulphuret of arsenic (69 arsenic and 31 sulphur), occurring *native* in various formations, either in the form of fine red prismatic crystals, or massive and disseminated. It is also prepared *artificially* from the sesqui-sulphuret or *yellow orpiment*, which see.

Recent (Lat. *recens*, fresh, still growing).—In geological classification the term *Recent* is applied to all accumulations and deposits which have taken place during the human epoch, or are still in progress of formation. All accumulations and deposits whose remains belong exclusively to species still existing, are, geologically speaking, “recent,” though chronologically of vast antiquity. By most geologists the Recent or Current epoch is regarded as commencing at the close of the Glacial or Boulder-drift period, as manifested in the northern hemisphere.

Reddle.—A provincial term for a red argillaceous ore of iron ; also called *red-clay* and *red-chalk*. It is simply decomposed hematite, having a compact earthy texture ; dry, meagre feel ; and strong clayey odour when breathed on.

Red Marl.—A familiar designation for the upper members of the New Red Sandstone or Trias, as developed in England. Known also as “variegated marls ;” the “Keuper” of the Germans ; and the “Marnes irisées” of the French.—See TRIASSIC SYSTEM.

Reef (Sax.)—A riff or ridge ; usually applied to a range or ledge of rocks occurring in the sea, and only partially covered, or placed at no great depth under the surface of the water ; as the “coral-reefs” of the Southern Ocean. Differs from a *shoal* or *bank*, which generally occupies a wider area and is for the most part composed of soft material, as mud, sand, and gravel.

Region.—A term often loosely applied in geography, but applicable to any large tract of sea or land which is characterised by some feature not to be found in other areas ; hence the idea of botanical, zoological, and similar “regions.”

Regnosaurus.—Literally “royal saurian ;” a provisional appellation applied by Dr Mantell to the imperfect remains (portion of a jaw and teeth) of a large saurian occurring in the Wealden strata of Tilgate Forest, and probably allied to *Megalosaurus* or *Iguanodon*.

Régur.—The native name for the cotton soil of India, which is said to cover nearly a third part of the southern peninsula, and to range northward to a great distance, and also into the Birman Empire. It occupies nearly level plains ; is of a bluish-black or greenish-grey colour—from three to twenty feet in thickness ; is of marvellous fertility ; and consists of 48.20 silica, 20.30 alumina, 16.00 carb. of lime, 10.20 carb. of magnesia, about 5 of organic matter, and a little oxide of iron. Like the *Tchernozem* of Russia and Loess of the Rhine it is evidently of alluvial origin, and may probably be of Upper Pliocene age.

Reindeer Period.—A term introduced by M. Lartet in 1863 to express a period later than that of the mammoth and rhinoceros in Europe, and when the reindeer was a prominent feature in the Post-tertiary fauna of the continent. The human remains belonging to the Mammothian period are the rudest form of flint implement ; those of the Reindeer period are

more advanced, and accompanied by carved horns, bone-needles, and the like.

Reliquis (Lat.)—Remnants; what is left behind. Usually applied to the remains of living creatures; but in geology extended to all *organic remains*, whether vegetable or animal.

Réniform (Lat. *ren*, kidney).—Kidney-shaped; applied, for example, to concretions of ironstone, limestone, &c., which assume a flattish-oblong or kidney-shaped form.

Reptilia (Lat. *repo*, I creep).—In zoological arrangements the third great division of vertebrate animals, embracing the Batrachians or frogs, the Ophidians or serpents, the Saurians or lizards, the Loricata or crocodiles, and the Chelonians or tortoises. As a class the Reptiles are cold-blooded; some have the body naked, others have it covered with scales, with plates or scutes, or enclosed in a horny shell; they are oviparous, but never hatch their eggs; and are partly terrestrial, partly aquatic, and partly amphibious. In one or other of the above orders they are found fossil, from the Devonian formation upwards—culminating as it were both in magnitude and in specific variety during the Oolitic epoch, which is sometimes styled “the age of Reptiles,” or “reign of Reptiles.”—See tabulations, “ANIMAL SCHEME.”

Resin (Lat. *resina*).—A well-known substance which exudes from many trees, and in particular from the firs and pines. It is usually of a yellowish or amber-brown colour, more or less transparent; becomes hard and brittle on exposure to the atmosphere; has a disagreeable taste and aromatic odour; is electric when rubbed; and has a specific gravity (1.0 to 1.3) little exceeding that of water. When heated it readily melts, and if the heat be much increased it takes fire and burns (like other hydro-carbons) with a whitish flame and much smoke. It is soluble in alcohol, ether, and the volatile oils, but is insoluble in water; and in this respect may be distinguished as well as separated from *gum*. It has been defined as “volatile oil rendered concrete by the oxygen of the atmosphere;” and as most plants contain some kind of volatile oil or other, the number of resins is very great. Substances partaking of the nature of gum and of resin (that is, partly soluble in water) are termed *Gum-resins*. Resins, gums, and gum-resins, occur in Tertiary and Post-tertiary formations, and in particular in connection with brown-coal and lignite.

Resin, Mineral.—As a family in mineralogical systems, the *Mineral Resins* include such hydro-carbons as petroleum, bitumen, asphalt, amber, retinite, copaline, hatchetine, and many other pitchy, fatty, or resinous-looking substances, which, with the exception of petroleum, asphalt, and amber, occur in small and unimportant quantities.

Resinous.—Resembling resin; containing or yielding resin; possessing the properties of resin. Hence we speak of certain minerals having a “resinous lustre,” a “resinous odour,” and so forth.

Retepóra (Lat. *rete*, a net, and *póra*, a pore).—Literally net-pore; the name given by Lamarck to a genus of fossil Bryozoa or compound molluscs, which, like the existing *flustra*, have their cell-pores arranged in net-like order. They occur in all formations.

Reticulated (Lat. *reticulum*, a small net).—Having the appearance of network; composed of fibres and veins or lines which interlace and cross each other like the threads of a net. The veins of an apple-leaf, for example, have this *reticulated* or net-like appearance.

Résinite, Résinite.—Known also as *retinasphalt*; one of the mineral resins occurring in brown-coal and peat formations, in roundish irregular lumps, of a yellowish-brown colour, resinous lustre, easily broken, and slightly transparent. It is an impure hydro-carbon or fossil resin, usually melts at a low heat, and burns with an aromatic or bituminous odour. According to Mr Hatchett, who first described it in 1804 from the lignite of Bovey in Devonshire, it consists of 55 resin, 41 asphalt, and from 3 to 4 of earthy residuum.

Reversed (Lat. *re*, back again, and *versus*, turned).—Turned upside down; turned side for side. A *reversed shell*, in conchology, is one whose whorls run from right to left, or whose aperture is turned to the left hand when the shell is placed before the spectator with its apex upwards.

Rhabdomancy (Gr. *rhabdos*, a rod, and *manteia*, prophecy).—Divination by rod or wand, so as to indicate where metals, minerals, and water may be obtained from the crust of the earth—a superstitious practice not altogether abandoned in some parts of Britain, and still to some extent followed in the south of France and Italy, under the names of *Metallascopy* and *Hydroscopy*. "The divining-rod," says Brande, "is a branch of a tree, generally hazel, forked at the end, and held in a particular way, by the ends, in the hand of the adept; and is supposed to indicate the position of the substance sought by bending towards it with a slow rotatory motion—the adept, according to modern practice, being placed in contact with some metallic or other magnetic substance."

Rhaetic Beds.—A term now generally applied to the "passage beds" that lie between the Trias and Lias, from their extensive development in the Rhaetic Alps. Known also as "Köessen Beds," "Gervillia Beds," "Tabinguen Beds," "Penarth Beds," "Infra-Lias," and the "*Avicula Confortia* Zone,"—some authorities ranking them as Upper Triassic and others as Lower Liassic.

Rhinoceros (Gr. *rhis*, *rhinos*, the nose, and *keras* horn).—Literally "snout-horned;" a well-known pachyderm of Asia and Africa, deriving its name from the solid fibrous horns (one or two in number according to species) which arm its snout. The living rhinoceroses are strictly inhabitants of the hotter parts of the Old World—the one-horned of Asia, and the two-horned and others of Africa; and all are heavy, bulky animals, delighting in marshy river-grounds, and feeding on leaves, soft roots, and succulent branches. Several fossil species occur in the later Tertiaries of Europe—in lake-silts, bone caves, and breccias; and more remarkable still, carcasses of one of these species (*R. tichorinus*) have been found in fair preservation in the frozen soil of Siberia. Though thus discovered ranging over the whole of Europe and northern Asia, we have no authentic instance of a fossil rhinoceros occurring either in America or Australia—a distribution that finds its parallel in the case of many other Tertiary animals.

Rhizodus (Gr. *rhiza*, root, and *odous*, tooth).—A genus of Carboniferous sauroid fishes, of large size, and originally confounded with *holoptychius*, but differing in the larger size of the species, in the form of the scales, which are rounded and marked with concentric wavy folds, and notably in the teeth, which are larger, compressed-conical, sharp at the compressed edges, and deeply striated towards the roots. The teeth are of two sorts, the large sauroid ones, often four and six inches in length, and placed at intervals along the jaws, and the smaller fish ones, which fill up the intervals and

are less boldly striated. Little is yet known of *Rhizodus* beyond the teeth, jaws, sculptured head-plates, and detached scales; and many teeth at one time regarded as those of *Rhizodus*, are now known to be those of *Labyrinthodont* saurians, as *anthracosaurus*, &c.

Rhizópoda, Rhizopods (Gr. *rhiza*, a root, and *pous, podos*, foot).—The lowest class of the Protozoa of modern zoologists. They are minute cellular animals (either simple or aggregated), and are so called from their motions being performed by processes or *root-like* extensions of the substance of which they are composed. They are interesting to the geologist, from the fact that the so-called *Foraminifera* which compose a large bulk of the Chalk, &c., are compound Rhizopods enclosed in a chambered shell-like case—each cell-body occupying its own chamber.—See *POLYTHALAMIA* and *FORAMINIFERA*.

Rhódium (Gr. *rhodon*, a rose).—A rare metal discovered by Wollaston in 1803, and usually associated with *osmium*, *iridium*, and *palladium* (other rare metals) in the ores of platinum. It derives its name from the red colour of one of its solutions, though its own colour is white or silver-grey. It is extremely hard, and used as nibs for gold pens.

Rhodócrinus (Gr. *rhodon*, a rose).—Literally “rose-encrinite;” a genus of Palæozoic encrinites in which the column is cylindrical and traversed by a pentagonal canal; the rays or arms arise by a single oscicle, and then bifurcate; the receptacle is formed of three, five, ten, or more numerous series of plates, which are ornamented externally by fine radiating ridges.

Rhódomite (Gr. *rhodon*, a rose).—A silicate of the protoxide of manganese; known also as manganese spar; and so named from its dark rose-red colour. It occurs in various formations and variously associated, and consists of 48 silica, 49 protoxide of manganese, with a little lime and iron.

Rhomb (Gr. *rhombos*).—In mathematics and crystallography, a four-sided figure whose sides are equal, but whose angles are not right angles; a compressed square, if one might so speak. **Rhomboid**.—Rhomb-like, lozenge-shaped; a four-sided figure having its opposite sides equal, but all its sides are not equal, nor are its angles right angles. **Rhombohedron**.—A solid figure contained within six equal rhombs.

Rhomb-Spar.—A variety of dolomite or crystallised magnesian limestone, already described under the name of BITTER-SPAR, which see.

Rhopáلودon (Gr. *rhopalos*, a club, and *odous, odontos*, tooth).—Literally “club-tooth;” the generic name applied by M. Fischer to certain reptilian remains from the Permian deposits of Russia. These remains consist of detached teeth and fragments of jaws with teeth, of thecodont reptiles, apparently related to the saurians from the Permian conglomerates of Bristol.—See *THECODONTOSAURUS*.

Rhynchonella (Gr. *rhynchos*, a beak).—Literally “little-beak;” a genus of brachiopodous bivalves, forming the type of the family *Rhynchonellidae*, and so named from their acutely beaked umbones. In *rhynchonella* the shell is somewhat trigonal, acutely beaked, usually plaited; dorsal valve elevated in front, depressed at the sides; ventral valve flattened, or hollowed along the centre; hinge-plates supporting two slender curved lamellæ. Only two or three living species are known, from the deeper waters of Arctic and Antarctic seas; but upwards of two hundred fossil species have been catalogued from the Lower Silurian upwards.

Rhynchosaurus (Gr. *rhynchos*, a beak, and *sauros*, lizard).—Literally “beak-saurian;” a remarkable genus of saurians from the New Red Sand-

stone of Warwickshire, combining the lizard type of skull with toothless jaws. "The general aspect of the cranium," says T. R. Jones, "resembles that of a bird or turtle, the intermaxillary bones being very long, and curving downwards, thus imparting to the fore part of the head the profile of a parrot. There are no teeth apparent in either jaw, and Professor Owen supposes that this reptile may have had its jaws encased by a bony or horny sheath as in turtles. Footmarks of a small reptile, with the print of the hind-toe pointed backwards, occur on the surface of some of the Warwickshire sandstones, and are, with much probability, conjectured to have been impressed by the *Rhynchosaurus*."

Rhyncholites, Rhyncholites (Gr. *rhynchos*, a beak, and *lithos*, stone).—The *Palæoteuthis* and *Rhynchoeuthis* of D'Orbigny. The fossil beak-like mandibles of cephalopods (like the cuttle-fish and nautilus) which generally occur detached in the Lias, Oolite, and Chalk formations. These calcareous mandibles are of two forms; those corresponding to the upper mandible constitute the "*Rhyncholites*" proper; whilst the lower mandibles form the genus "*Conchorhynchus*" of De Blainville.

Rhytidolépiss (Gr. *rhytis*, *rhytidos*, a wrinkle, and *lepis*, scale).—The term applied by Sternberg, Cotta, and others to the *Sigillaria*, in allusion to its thick corrugated outer bark.—See SIGILLARIA.

Rhytina.—A genus of phytophagous Cetaceans, or rather Sirenians, discovered by Steller on Behring's Island in 1741, and since completely extirpated—the last individual having been killed in 1768. Like the Dodo and Dinornis the Rhytina is considered extinct, its remains (from 8 to 24 feet in length) being now eagerly sought after for our public museums. Unlike the manatees or sea-cows, the Rhytina was edentate, having special bony palatal apparatus for the crushing of its food.

Ripple-Mark.—This term is applied by geologists to the ridgy or wavy surface of many sandstones, from its resemblance to the ripple produced on a sandy sea-shore by the receding tide. As this ripple is produced by the passage of any gentle current over a movable surface, we have *wind-ripples*, *tide-ripples*, *current-ripples*, and the like; and it requires discrimination on the part of the observer to determine the nature of the producing cause in the ancient formations.

Rise.—In mining, any vertical or upward opening from a lower to a higher portion of a vein, or it may be to the surface.

River (Lat. *rivus*; Gr. *rheo*, I flow).—Geologically, streams and rivers act chiefly in a mechanical way, and their influence depends partly on the nature of the rocks over which they run, the rapidity of their flow, and their size or volume of water. If the rocks over which they pass be of a soft or friable nature, they soon cut out channels, and transport the eroded material in a state of mud, sand, and gravel to the lower level of some lake, to their estuaries, or to the bed of the ocean. Their cutting as well as transporting power is greatly aided by the rapidity of their currents; hence the power of mountain torrents compared with the quiet and sluggish flow of the lowland river. It has been calculated, for example, that a velocity of three inches per second will tear up fine clay, that six inches will lift fine sand; eight inches, sand as coarse as linseed; and twelve inches, fine gravel; while it requires a velocity of twenty-four inches per second to roll along rounded pebbles an inch in diameter, and thirty-six inches per second to sweep angular stones of the size of a hen's egg. During periodical rains and land-floods the currents of rivers often greatly exceed this velocity;

hence the tearing up of old deposits of gravel, the sweeping away of bridges, and the transport of blocks many tons in weight—an operation greatly facilitated by the fact that stones of ordinary specific gravity (from 2.5 to 2.8) lose more than a third of their weight by being immersed in water. Nor is it the mere velocity of rivers which produces their eroding or cutting power, but the amount and nature of the debris carried down by their torrents—every pebble and block of shingle rubbing and striking and grinding still deeper and deeper the channels down which they are borne. The geological effects of rivers on the crust is thus of a twofold nature—viz., to waste and wear down the higher lands, and then to bear along the waste material and deposit it in valleys, in lakes, or in the ocean, in the state of mud, clay, sand, or gravel.—See *DELTA*.

River-Basin.—In geography, the whole extent of valley-shaped or basin-shaped country drained by any river and its tributaries—e.g., the “Basin of the Tay,” the “Basin of the Severn.”

Roadstead or Roads.—Usually applied to an open and exposed anchorage where ships may ride under the lee or shelter of the land, but from which they must sail when the wind is about to blow strong from the sea.

Roches Moutonnées.—The name given by French geologists to those rounded projecting eminences of Alpine rocks that have been worn down and smoothed by glacier action.

Rock.—The “crust,” or external portion of the earth accessible to human research, is composed of substances less or more solid, and all known to the geologist by the name of *Rocks*—these rocks the products, in the main, of aqueous and igneous agencies. No matter whether in the state of soft and yielding clay, of incoherent sand and gravel, of dull earthy chalk or sparkling marble, of friable sandstone or the hardest granite—all are spoken of as “rocks” and “rock-formations.” In this sense the term *rock* is purely technical; and it has even been proposed by German mineralogists to extend the term to ice and water as being principal constituents of the earth’s mass.

Rock-Basins.—Curious basin-shaped cavities occurring in the granites of high and exposed regions like that of Dartmoor in Devonshire, and varying from one to many feet in diameter, and from a few inches to several feet in depth, with edges more or less sloping, and generally containing pebbles or other gravely detritus whose motion, with the aid of water, seems to have been the efficient cause of their formation. At one time superstition ascribed the excavation of these “basins” or “pot-holes” to the Druids; but no one now for a moment doubts that, however these early priests may have used them, they are the direct results of decomposition and attrition on the softer portions of the felspathic granite.—See vol. xv. of ‘*Geological Journal*’ for some interesting details of the Dartmoor basins, by Mr Ormerod.

Rock-Butter.—A soft, yellowish admixture of alum, alumina, and oxide of iron, oozing out of rocks which contain alum. A product of decomposition.

Rock-Cork.—A variety of asbestos whose fine fibres are so interlaced and matted as to give it the texture and lightness of cork. Occurs in veins and crevices in serpentine and similar rocks, and often known as “mountain-cork.”—See *ASBESTUS*. •

Rock-Crystal.—A familiar term for the transparent and colourless varieties of crystallised QUARTZ, which see. Though usually colourless and

transparent, "rock-crystal" occurs in various shades, and the term is even extended to smoke-coloured and perfectly black varieties. It is customary, however, to distinguish the coloured varieties by separate names; hence the purple are known as *amethysts*; the yellow, *topazes*; the amber-coloured, *cairngorms*, and so on. Rock-crystal is found in veins, fissures, and other cavities in every geological formation, but chiefly and most perfectly in the older crystalline and granitic rocks. The primary form is rhombohedral, but it usually occurs either in six-sided prisms, acutely terminated by six planes; in acute simple six-sided pyramids; or in such prisms and pyramids doubly terminated. The largest and finest specimens are obtained from the Alps, Pyrenees, Siberia, Brazil, Ceylon, Madagascar, and in a less degree from Saxony, Norway, and the Scottish Highlands. The purest sorts consist almost entirely of siliceous matter, with a trace of alumina, lime, oxide of iron, or other colouring matter; have a fine vitreous lustre, a specific gravity of from 2.5 to 2.8, and a hardness of 7, being in this respect only inferior to corundum and diamond.

Rocking-Stones.—Weather-worn rounded blocks, generally of granite or tabular greenstone, so nicely poised on their basis that a very ordinary force suffices to make them oscillate or "rock" from side to side.—See LOGAN-STONES.

Rock-Oil.—The familiar as well as commercial term for *Petroleum* or *Mineral-Oil*, which see.

Rock-Salt.—The familiar as well as scientific term for common salt (chloride of sodium), when it occurs in the earth's crust as a solid rock-mass. In the British Isles the great repository of rock-salt is the Trias or Upper New Red Sandstone; but deposits of equal magnitude are found in connection with Oolitic strata, as in the Salzburg Alps, with Cretaceous greensands as at Cordova in Spain, with Chalk and Tertiary rocks in the valley of Cardona in the district of the Pyrenees, with Tertiary marls as in Sicily and at Wielitska in Poland; and salt springs are known to issue from Carboniferous and older strata. It is thus a product of all epochs, and must have been formed either by the gradual and long-continued desiccation of limited areas of salt-water alternately cut off and placed in connection with the ocean, or by precipitation from saturated solutions, perhaps brought about by the evaporating power of volcanic or other thermal agency. The Cheshire deposits of rock-salt, which may be taken as a typical illustration, lie along the line of the valley of the Weaver, in small patches, about Northwich. There are two beds lying beneath 120 feet of coloured marls, in which no traces of animal or vegetable fossils occur. The upper bed of salt is 75 feet thick; it is separated from the lower one by 30 feet of coloured marls, similar to the general cover; and the lower bed of salt is above 100 feet thick, but has nowhere been perforated. They extend into an irregular oval area, about a mile and a half in length, by three-quarters of a mile in breadth. The salt in these deposits is sometimes pure and transparent, and at other times is of a dirty reddish hue, and mixed to the amount of half its bulk with earthy impurities. It is not stratified or laminated, but divided into vertical prisms of various forms and magnitudes, sometimes more than a yard in diameter—the outer sides of these rude crystallisations being generally pure and transparent.

Rock-Soup.—Known also as *mountain-soup*; one of the clays or silicates of alumina, of a pitch-black or bluish-black colour, slightly greasy feel, writes but does not soil, adheres strongly to the tongue, and falls to pieces

in water. Occurs in veins and fissures. The compacter sorts are cut into crayons ; the softer are used as a fulling material.

Rock-Wood.—A variety of absestus, of a brown colour, and occurring in long compacted fibres which give it the aspect and texture of wood ; hence the name.—See **ASBESTUS**.

Rodéntia (Lat. *rodo*, I gnaw).—Literally rodents or “gnawers ;” an extensive class of mammals, so called from their habit of gnawing or nibbling their food, which generally consists of the harder and drier vegetable substances, and for which purpose they are provided with sharp chisel-shaped incisors—*e.g.*, the rat, hare, beaver, squirrel, and porcupine.

Roestone.—A familiar English term for *Oolite*, from its being composed of an aggregation of small rounded grains or spherules, which, taken in the mass, present considerable resemblances to the roses of fishes. The larger-grained varieties are known as *peastones* or *pisolites*, and the irregular-grained as *pea-grits*, &c.—See **OOLITE**.

Roof.—In coal-mining, the stratum or material immediately overlying the workable coal, from its forming, as it were, a roof or covering to the operations of the miner. In metalliferous veins, the overhanging part or wall of the vein.

Rosalina (Lat. *rosa*, a rose).—A genus of many-celled foraminiferous organisms, so called from the circular or rose-like disposition of the chambers. In *Rosalina* the cells are arranged round a central spire in one or more whorls, the outer chambers gradually becoming larger and more inflated. The opening is on the under or depressed side, and the whole external surface is minutely punctured.

Rose-Quartz.—A more or less transparent variety of quartz of a fine rose-red or pink colour ; massive ; and when sufficiently free from flaws is cut and polished as an ornamental stone.

Rostellária (Lat. *rostellum*, a little beak).—One of the Strombidae or Wing-shells, of which five or six species inhabit the Indian and Chinese seas at moderate depths, and of which upwards of seventy species occur fossil, from the Lower Greensand inclusive. Shell with an elongated spire ; whorls numerous and flat ; canals long ; outer lip more or less expanded, with a single sinus close to the beak. The older Tertiary species have the outer lip enormously expanded and smooth-edged ; those with keeled and spiniferous whorls form the sub-genus *Spinigera*.

Rotália, Rotálites (Lat. *rota*, a wheel).—A genus of foraminiferous shells, so called from their nautiloid wheel-like contour. They are extremely minute, and appear in the Lias, Oolite, and Chalk in immense numbers and many species, and still swarm in the present seas. Though nautiloid in their aspect, they are regularly turbinated, the cells decreasing in size towards the apex or centre.

Roth-todte-liegende.—Literally “red-dead-liers ;” the name given by German miners to the red sandstones and marls which lie under the *Kupfer-schiefer* or copper-slate, because they are “dead” or non-metalliferous. They seem to be the equivalents of the lowermost Permian sandstones of the north of England.

Rotifera (Lat. *rota*, a wheel, and *fero*, I bear).—An order of infusorial animalcules, so called from the revolving wheel-like motion of the rows of vibratile cilia (hair-like processes) which surround their mouths, and by which they move through the water, as well as create currents to bring within their reach the organised atoms on which they feed. They are

divided into *Nuda* and *Loricata*—the former having the body soft and naked, the latter covered with a sheath.

Rotten-Stone.—A siliceo-aluminous compound, resulting from the decomposition of impure limestone by the percolation of carbonated waters. Most of the rotten-stone of commerce (used for polishing metals, &c.) is derived, like that of Derbyshire, from the decomposition of siliceous limestones—the lime being decomposed, and the silex remaining as a light earthy mass.

Rowley-Rag.—The hard, fine-grained crystalline greenstone constituting Rowley Hill in the Dudley coal-field. "This trap-rock," says Mr T. R. Jones, "supplied the materials for the important experiments by Gregory, Watt, and Sir James Hall on the fusion and cooling of rocks; and has of late been employed by Messrs Chance, at Oldbury, near Birmingham, in the manufacture of molten indestructible architectural materials."

Rubble.—A quarryman's term for the loose covering of angular fragments which appear at the outcrop of many sandstones. Applied also to all accumulations of loose angular fragments not water-worn and rounded like gravel and shingle.

Rubellite (Lat. *rubeo*, to flush with red).—A mineralogical term for the fine red varieties of TOURMALINE, which see.

Rubicelle.—A lapidary's term for the fine yellow or orange-red varieties of the spinel RUBY, which see.

Ruby (Lat. *rubeo*, I flush with red).—A mineralogical and lapidary's term for the fine red transparent varieties of *Spinel* and *Corundum*, which see. The finest red and violet varieties are obtained from Ceylon, Ava, and other parts of the East, hence known as the *Oriental ruby*, and which, when uniform in colour, free from flaws, and large, ranks next to the diamond among gems. It is customary to distinguish the rose-red varieties as *Balas-ruby*; the yellow or orange-red as *Rubicelle*; and the violet as *Almandine ruby*; but of course there are many intermediate shades, as there are diversities of composition, among the so-called "rubies" of the lapidary and jeweller. The "corundums" proper consist almost entirely of alumina, with a minute proportion of iron peroxide or other colouring matter; the "spinel," on the other hand, contain from 10 to 20 per cent of magnesia, with minute but varying proportions of silica, lime, and chrome. Both corundum and spinel are found *in situ* in gneiss and granitic rocks; but the chief supply of the "rubies" of commerce is obtained from the gravelly detritus of streams and mountain torrents.

Rugose (Lat. *ruga*, a wrinkle).—Full of wrinkles; having a coarse irregular surface like the bark of an old oak or elm; covered with many wrinkles or minute folds, like the shell of the *Buccinum undatum* or common whelk.

Ruin.—A term occasionally employed in familiar description for certain minerals, whose sections or cut faces exhibit the appearance of ruined buildings, as *Ruin-agate*, or brecciated agate, *Ruin-marble*, or Cotham marble, &c.

Ruminántia (Lat. *ruminare*, to chew the cud).—An important group of quadrupeds, often referred to in zoology and paleontology, and including those which, like the ox, deer, goat, sheep, &c., *ruminate*, or chew the cud. They are all vegetable-feeders, have cloven hoofs, and are void of canine and incisive teeth in the upper jaw.

Rusophycus (Gr. *rusos*, wrinkled, and *phycos*, sea-weed).—A genus estab-

lished by Professor Hall for certain transversely-wrinkled impressions found in rocks of the "Clinton Group" (Middle Silurian) of New York, and supposed to be fossil sea-weeds, whence the name. These curious and irregular markings have since been found in other Palæozoic rocks of America, and Dr Dawson suggests that they may be the casts of the impressions of the laminated gill-feet of trilobites, and that they may have been connected with the place of incubation at the end of burrows.

Rust (Sax).—The powdery oxide or tarnish which covers the surfaces of metals exposed to the action of a moist atmosphere; hence we have the well-known "iron rust," "copper rust," and so on.

Rutile, Rutile (Lat. *rutillus*, shining red).—Native binoxide of titanium coloured by the peroxide of iron, and so called from its deep and often dark-red colours. It usually occurs in long prismatic or acicular crystals, and is common in granite, gneiss, and mica-schist, often investing and penetrating rock-crystal in these formations. It is used in porcelain-painting to produce a yellow colour.

Ryacolite (Gr. *ryax*, *ryakos*, a stream, and *lithos*, stone).—A species of felspar, whitish, transparent, and of vitreous lustre; so called from its being found with augite, nepheline, and mica in the lava-streams of Vesuvius. Many of the so-called "glassy felspars" belong to this species, which consists of 50 silica, 30 alumina, 10.56 soda, and 6 potash, with traces of lime and magnesia.

S

Saarbruck, in Lorraine, whose coal formation abounds in beautiful specimens of *Palæoniscus*, *Amblypterus*, and other allied fishes. These organisms occur in the slaty shales and in the ironstone nodules.

Saccharite (Lat. *saccharum*, sugar).—A species of felspar occurring in fine granular masses, of a vitreous lustre, and white or greenish-white colour; whence the name. It is found in veins in serpentine, in the chrysoprase mines, near Frankenstein in Silesia.

Saccharoid (Gr. *sakchar*, sugar, and *eidos*, likeness).—Resembling loaf-sugar in texture; applied to crystalline limestones like the fine statuary marble of Carrara.

Sacrum, Sacral.—In anatomy, the posterior bone of the pelvis, articulated to the last lumbar vertebra, and firmly united on each side to the hip-bones, forming, as it were, the "key-stone" of the pelvic arch. In young animals the *sacral vertebrae* (which are of variable number in different groups) are generally distinct and separable, but become united or ankylosed (less or more) into one piece, according to age and specialties of structure.

Saddle-Back.—A familiar term for anticlinal strata, from their sloping or dipping right and left in saddle form. In mining phraseology, the sides or slopes of a saddle-back or anticline are termed its "wings."—See **ANTICLINE**.

Safety Lamp.—A lamp invented by Sir Humphry Davy to prevent the explosion of fire-damp in coal-mines, familiarly termed by the colliers a "Davy." It consists of a lamp completely surrounded by *wire-gauze*, having a mesh from $\frac{1}{16}$ to $\frac{1}{8}$ of an inch in width, and through which the explosive mixture cannot, under ordinary circumstances, be fired. There are various modifications of this invention by Stephenson, Clanny, Meuserler, and others; but in all, the essential principle is the non-transmission of flame through tubes or openings whose diameters do not exceed the fortieth part of an inch—the wire-gauze acting merely by its cooling power.—See DAVY LAMP.

Sáhlite.—A variety of augite, so called from its being discovered in the silver-mines of Sahla in Sweden. It occurs in columnar, lamellar, or granular concretions, usually of a light or greyish-green colour, of a shining pearly lustre, and, for the most part, imbedded, as in iron and lead ores, and in altered limestones.—See AUGITE.

St Cuthbert's Beads.—A North of England term for the detached bead-like joints of the encrinite, from a legend alluded to by Sir Walter Scott in 'Marmion,'—

"On a rock by Lindisfarne,
St Cuthbert sits, and toils to frame
The sea-born beads that bear his name."

St Peter's Finger.—An old and familiar term of the English peasantry for *Belemnites*, many of which are of a finger-like form.

Salamandróides (literally, salamander-like).—The term originally applied by Dr Jäger to certain salamander-like remains from the Upper New Red Sandstone of Wirtemberg; but since critically examined by Professor Owen, and classed with LABYRINTHODON, which see.

Sal-Ammoniác.—Muriate or hydrochlorate of ammonia; so called from the Temple of Ammon in Egypt, where it was originally obtained by burning camel's dung. It is now largely procured by other processes, and occurs *native* in crusts, stalactites, and pulverulent masses, chiefly in the rents and fissures near active volcanoes. It is of a greyish or yellowish white, according to impurities of iron, sulphur, &c.; has a saline pungent taste; is easily soluble in water; and volatilises without fusing. Used in medicine, dyeing, and various metallurgic operations.

Salámstein, Salámstone.—A familiar term for the fine blue transparent varieties of Oriental *Sapphire*, which see.

Saliferous (Lat. *sal*, salt, and *fero*, I yield).—Containing or yielding salt, as "saliferous strata," "saliferous deposits," &c. *Saliferous System* was at one time used by English geologists as synonymous with Upper New Red Sandstone, which is the great repository of rock-salt and brine springs in England; but as other formations in different countries are equally rich in this mineral, the designation has been all but abandoned for that of *Trias* or *Triassic*.—See ROCK-SALT.

Salifiable (Lat. *sal*, salt, and *fo*, I become).—Having the property of becoming a *salt*; capable of being converted into the form of a salt by combination with an acid; hence the "salifiable bases" of the chemist.

Salinas.—The name given in South America to those superficial deposits which often occupy extensive plains on the Pacific or rainless side of the Andes, and which are usually covered with a white saline efflorescence or crystalline incrustation. They occur at all elevations, from a few feet to several thousand feet above the sea-level, and are evidently the remains

of old sea-reaches and lagoons that have been desiccated by the upheaval of the land. They extend for about 600 miles north and south, but find their greatest development between latitudes 19° and 25° south, and at distances varying from 10 to 40 miles inland. The usual salts occurring in these "salinas," as in those near Iquique and the desert of Atacama, are common salt, Epsom salt, Glauber-salt, thenardite, glauberite, soda-alum, magnesia-alum, gypsum, anhydrite, along with chloride of calcium, iodide and bromide of sodium, carbonate and nitrate of soda, and in some places borate of lime and borax.

Saline (Lat. *sal*, salt).—Containing or impregnated with salt; as "saline springs," "saline incrustations," &c.

Sal-Mirabile (Lat.)—Literally "wonderful salt;" a term of the older chemists for sulphate of soda or *Glauber-Salt*, which see.

Salses.—Eruptions of hot acidulated mud from small orifices, generally in volcanic districts, and often accompanied by steam and gases at a high temperature, which act powerfully on the surrounding solid matters, disintegrating and decomposing them, and forming new compounds. In some districts the gases are inflammable, and flames issue from the orifices.

Salt (Gr. *hals*, Lat. *sal*).—This term, though in ordinary language limited to common salt or sea-salt, is in chemistry and mineralogy applied to all combinations of acids with alkaline or salifiable bases; hence we have such terms as *haloid salts*, *copper salts*, *lead salts*, and the like. "The nomenclature of salts," says Brande, "has reference to the acids which they contain; *sulphates*, *nitrates*, *carbonates*, &c., implying salts of the sulphuric, nitric, and carbonic acids. The termination *ate* implies the maximum of oxygen in the acids, and *ite* the minimum; thus the salts of sulphurous and nitrous acids are called *sulphites* and *nitrites*. When salts contain one equivalent of acid and one of base, they are called *neutral salts*; where one equivalent of acid is combined with two of base, they are termed *basic salts*, *subsals*, or *disalts*; and where there are two equivalents of acid and one of base, the salt is a *supersalt* or *bisalt*. Thus the terms *subacetate of lead* and *diacetate of lead* are synonymous; so are *supercarbonate* and *bicarbonate of potash*. Many salts are *hydrous*—that is, they contain a definite proportion of water of crystallisation; others are destitute of water, and are dry or *anhydrous* salts. Some attract moisture when exposed to the air, and are said to be *deliquescent*; others suffer their water to escape and become opaque or pulverulent, and are said to be *efflorescent*." **Common Salt**, which is a chloride of sodium, is obtained either by the evaporation of sea-water and brine-springs, or by the treatment and purification of rock-salt. It is indispensable as a condiment or article of food, and is largely employed in glass-making, enamelling, glazing, bleaching, and other industrial processes.

Saltpêtre (Lat. *sal*, salt, and *petra*, stone).—A familiar term for nitrate of potash, or *Nitre* (which see), from its being found native generally in loose stony soils.

Sánadine (Gr. *sanis*, a board, in reference to the tabular form of the crystals).—An occasional synonyme for glassy felspar, a variety of *Orthoclase*, or potash-felspar, which see.

Sand (Sax).—Any aggregation of water-worn particles, derived from pre-existing rocks and other mineral substances. Sand is generally composed of quartz-grains (quartz being one of the hardest of simple minerals, and longest resisting the processes of attrition); but it may also consist of the

particles of shells, corals, &c.; hence such terms as "shell-sand," "coral-sand," and the like.

Sand-Drift.—The general term for all wind-blown sands, whether occurring in inland deserts or along the sea-shores. In both situations it presents much the same appearance, namely, ridges, hillocks, or *sand-dunes* more or less parallel, and lying of course across the direction of the prevalent winds. Sand-drift occurs largely along the shores of our own island, forming "Links" or "Dunes," generally covered with the sand-reed and other coarse herbage, and rising in ridges from twenty to sixty feet in height.

Sand-Pillars.—The ordinary name for the sand-storms of desert tracts like those of the Sahara and Mongolia, because they assume a whirling and pillar-like form in their onward march. "They often come on," says Mr Michie, who crossed Mongolia in 1863, "after a sultry day. A yellow haze appears in the sky, darkening the sun; then columns of fine dust are seen spinning round in whirlwinds. At that stage every living thing seeks shelter, and those who are afield are lucky if they are not caught in the blinding storm before they reach their houses. It has been supposed that they are due to some peculiar electrical condition of the atmosphere."

Sand-Pipes or Sand-Galls.—The name given to those cylindrical or pipe-like hollows, often of considerable depth, which occur in chalk rocks, and which are usually filled up with sand and gravel and clay from above. These "pipes" have been ascribed by some to the wearing, rotatory motion of sand and pebbles which form the "pot-holes" of existing shores; and by others, with greater reason, to the percolation of water charged with carbonic acid—the corroding action being often confined to a narrow tube a few feet in diameter, and upwards of 20, 40, or 60 feet in depth.

Sand-Scratches.—"The sands carried by the wind," says Professor Dana, "when passing over rocks, sometimes wear them smooth or mark the surface with scratches and furrows, as observed by W. P. Blake over granite rocks at the pass of San Bernardino in California. Even quartz was polished and garnets were left projecting upon pedicles of felspar. Limestone was so much worn as to look as if the surface had been removed by solution." Such appearances are apt to be mistaken for those of glacialization, and require careful observance.

Sandstone is simply consolidated sand—the particles (whether siliceous or calcareous) having been compacted by pressure, or being held together by lime, clay, oxide of iron, or some other cementing material. Some sandstones, like those of Edinburgh and St Andrews, contain upwards of 98 per cent of pure silica, the remainder being lime, alumina, and iron.

Sapónaceous (Lat. *sapo*, soap).—Feeling like soap to the touch; having a soapy feel, as steatite, and many other allied minerals. Also, capable of being worked into a lather like soap, as the juice or mucilage of many plants, aquatic and terrestrial.

Sapphire (Gr.)—A highly transparent variety of corundum, with a very imperfect cleavage and conchoidal fracture—those of fine red colours being often named "Oriental rubies;" those of blue, "Salamstein;" those of yellow or white, "Oriental topaz;" those of green, "Oriental emerald," &c. It consists of alumina, with a trace of peroxide of iron and other colouring matter, and is the hardest of all known gems, except the diamond. The "sapphire blue" of the Greeks and Romans seems to have been the *lapis lazuli*, and not this gem.

Sarcode (Gr. *sarz*, flesh, and *eidos*, resemblance).—The term applied by Dujardin to the simple glutinous (or fleshy-like) substance which constitutes the body or vital mass of the protozoa or lowest forms of animal life—*e.g.*, the jelly-like substance which constitutes the body of the *amoeba*, and the glairy coating which invests the horny framework of the sponge.

Sárcolite (Gr. *sarz*, flesh, and *lithos*, stone).—An unimportant variety of *Analcime* (one of the Zeolites); and so called from its fine flesh-colour.

Sardónyx.—A variety of onyx (which see); and said by some to derive its name from *Sardes* in Lydia, and by others from *Sardo*, the Greek name for Sardinia—both being localities from which it was obtained for cameo manufacture.

Sarsen Stones.—The name given in the south of England to those large tabular blocks of sandstone which are scattered over the surface of the chalk downs, and which, from their partially worn and weathered aspect, are evidently the remains of the once superincumbent Eocene strata which have been removed by denudation. Known also as *Druid-stones* and *Grey-wethers*, which see.

Sásoline (from *Sasso*, near Sienna).—The mineralogical term for *boracic acid*, which occurs in thin, scaly, irregular six-sided crystals, of a whitish colour, pearly lustre, and less or more translucent. The crystals have an acidulous and slightly bitter taste, feel greasy, and are easily soluble in boiling water. Boracic acid (or “hydrous boracic acid,” as it is often termed) occurs, with various impurities, in many volcanic regions; in the hot springs of Sasso, near Sienna; and in the *lagoni* of Tuscany, where many thousand pounds are annually obtained by evaporating the water.

Satin-Spar.—A familiar term for the finely-fibrous, silky varieties of *Arragonite*, or prismatic calc-spar, many of which are susceptible of a fine polish, and exhibit the lustre of satin; whence the name.

Saturated (Lat. *saturatus*, full).—Full to overflowing; water saturated with salt, is water that can dissolve no more of that substance—every additional particle that is added to this “saturated solution” falling to the bottom undissolved.

Sáurian (Gr. *sauros*, a lizard).—Of or pertaining to the *Saurians*, or scaly reptiles, of which the common lizard has been taken as the representative. As a section, the Saurians comprehend the lizards, monitors, iguanas, chameleons, &c., all well-known forms among living species; and the ichthyosaurus, plesiosaurus, deinosaurs, iguanodon, and numerous other extinct and gigantic forms, some of which were marine, others terrestrial—some carnivorous, and others herbivorous. As an order, the Saurians are characterised by their elongate rounded bodies, densely covered with imbricated or granular scales; by their elongate, tapering, usually scaly tails; limbs four, but occasionally rudimentary, and completely concealed under the skin; ribs distinct and movable; sternum distinct; mouth not dilatable, jaws toothed; eyes and ear-cavities prominent and exposed; eggs with a hard skin or crust; and young not undergoing any metamorphosis.—See tabulations “ANIMAL SCHEME.”

Saurocéphalus (Gr. *sauros*, lizard, and *kephale*, head).—Literally “lizard-headed;” a genus of fossil fishes of the Cycloid order of Agassiz, found in the Chalk formation, and so named from the peculiar formation of the head.

Sáurodon (Gr. *sauros*, lizard, and *odon*, tooth).—Literally “lizard-

toothed ;" a genus of fossil fishes of the Cycloid order, found in the Chalk, and so termed from the sauroid character of their teeth.

Sauroid (Gr. *sauros*, lizard, and *eidos*, likeness).—Like or akin to the Saurians; a convenient term implying affinity or resemblance without asserting absolute identity.

Sauroidal.—One of Agassiz's orders of fossil fishes; so called from their exhibiting, in their structure and dentition, certain *sauroid* or reptilian characters. They occur in the Carboniferous, Permian, Oolitic, and Chalk systems; and their remains (teeth, bones of the head, &c.) often indicate fishes of great size and pre-eminently predaceous habits; e.g., *megalichthys*, *sauropsis*, *saurichthys*, &c.

Sauroidal-Dipterini.—One of Agassiz's orders or sub-orders of fishes, mainly characterised by having rows of true *fish-teeth* on the outer edges of the jaws, and irregularly implanted *reptilian teeth* on the inner plates. The forms are chiefly Devonian, and embrace such genera as *dipterus*, *diptolepis*, *osteolepis*, *glyptolepis*, &c.

Sauropsis (Gr. *sauros*, lizard, and *opsis*, appearance).—A genus of sauroid fishes occurring in the Oolitic system, and so named by Agassiz from certain characteristics of their dentition.

Sauropterygia (Gr. *sauros*, a lizard, and *pteryx*, a wing or fin).—One of the thirteen orders into which Professor Owen proposes to arrange the Reptilia, living and extinct. The fins in this order of marine reptiles (of which the Plesiosaur may be taken as the type) do not include more than five digits, and resemble those of turtles; hence the name. There are no post-orbital and supra-temporal bones; there are large temporal and other vacuities between the cranial; there are two ante-orbital nostrils; teeth simple, in distinct sockets of the premaxillary, maxillary, and pre-mandibular bones, the maxillaries being the larger; limbs natatory, with not more than five digits; a sacrum of one or two vertebrae for the attachment of the pelvic arch in some; cervical vertebrae numerous; pleuropophyses have simple heads, those of the trunk being long and bent.—See tabulations, "ANIMAL SCHEME."

Saundersite.—An impure variety of *Labradorite*, or Labrador felspar, occurring in compact, sub-translucent masses, of a bluish or greenish grey, in many hypersthene rocks; and so named in honour of the French philosopher Saussure.

Savannah, Savanna (Fr.).—An American term for any vast grassy plain or *prairie*; but usually applied to the great central plain of North America, which may be said to stretch, with little perceptible interruption, from the Gulf of Mexico to the Arctic Ocean.

Scaglia (Ital., a scale or chip).—An Italian calcareous rock, the equivalent of our white chalk. In the north of Italy it contains nodules and layers of flint; yields ammonites, belemnites, and the like; is of a red colour, and has a fissile structure; hence the name.

Scagliola (Ital., diminutive of *scaglia*).—An artificial composition employed in architectural facings and ornamentation; consisting of pure finely-powdered Plaster-of-Paris, or calcined gypsum, Flanders glue, isinglass, &c.; and made to resemble the natural *scaglia* limestone. Known also as *Mischia*, from the mixture of colours employed in it, being made to imitate marble.

Scalariform (Lat. *scalaris*, a ladder, and *forma*, form). Presenting the appearance of a ladder; applied by botanists and microscopists to certain

vessels in the woody structure of the cycads and conifers having an elongated form, and crossed by connecting fibres, like the steps of a ladder.

Scalent (Lat.)—Climbing; the sixth of the fifteen series into which Professor Rogers subdivides the Palæozoic strata of the Appalachian chain—the “Climbing Day,” of the North American Palæozoics, and the equivalents in part of our Upper Silurians.—See PALÆOZOIC FORMATIONS.

Scâpheus (Gr. *skapheus*, a digger).—A genus of macrurous crustaceans from the Lias of Lyme Regis, characterised by its spiny cephalo-thorax, prominent rostrum, strong spiny limbs, hirsute abdominal segment, and laminated telson or tail-plate. The fore-limbs are monodactylous or single-fingered, and seem to indicate fossorial habits, whence the name.

Scâphite (Lat. *scapha*, a skiff).—A genus of the Ammonite family, peculiar to the Chalk formation, and so named from the boat-like contour of its shell—the inner whorls looking like an ancient reversed prow, and the last chamber, which is free, produced horizontally, and then sharply recurved, forming, as it were, the boat and stern.

Scapolite (Gr. *skapos*, a rod, and *lithos*, stone).—A silicate of alumina and lime occurring in long prismatic (rod-like) crystals which lie parallel, diverge, or cross each other, and are either imbedded or in drusy cavities. It is also found massive with a granular or columnar structure; is less or more transparent; has a vitreous or resinous lustre; and is colourless or coloured—pale-grey, greenish-yellow, or red. Its composition is very uncertain. It is found in metalliferous veins, in beds of crystalline limestone, and usually associated with calc-spar, quartz, felspar, and mica. It has been taken as the type of the Scapolite family, which includes several closely-allied minerals—*palagonite*, *nepheline*, *prehnite*, *nephrite*, &c.—See tabulations, “MINERAL SCHEME.”

Scâpula, **Scâpular Bone** (Lat.)—The shoulder-blade; a bone which, from its size and position, is frequently found detached in a fossil state. “It is broad and flat, generally triangular, sometimes sub-quadrilateral, in Mammals; narrow and commonly sabre-shaped in Birds; narrow and straight in Saurians; a round, strong, and straight column in Chelonians; and variously shaped and articulated to the back of the skull in most Fishes.”

Scar or **Scaur** (Sax.)—A bluff precipice of rock; hence the term “Scar Limestone,” applied to the mountain limestone as it occurs in the hills of Yorkshire and Westmoreland, occasionally corrupted into “score” and “skaour.”

Scar-Limestone.—The name given by English geologists to the lower group of the Carboniferous Limestone, as developed in bluff precipices and lofty “scars” in the north-western districts of Yorkshire and in Westmoreland.

Scarped (Fr. *escarper*, to cut steep).—Having a steep face; worn or cut away so as to present a steep precipitous face.

Scheelite.—Tungstate of lime; consisting of 81 tungstic acid and 19 lime; and occurring in the veins of the older rocks in imbedded four-sided pyramidal crystals, or in reniform and amorphous-granular crusts, of a greyish-white, yellowish, or brownish colour, vitreous lustre, translucent and brittle. Named after the Swedish chemist Scheele, who first discovered tungstic acid in this mineral.

Scheererite (after Von Scheerer, its discoverer, in 1822).—One of the

mineral resins occurring in brown-coal and peat, in crystalline grains and scales, and in minute acicular crystals, of a white or yellowish-green colour; pearly lustre, soft and very friable, and without odour when cold. Melts at 111° Fahr. into a colourless fatty liquid; inflames readily, and burns completely away, giving out much smoke and a faint aromatic smell.

Schiller-Spar (Ger. *schillern*, to change colour).—A massive magnesio-siliceous mineral (hydrated silicate of magnesia) of a greyish-green or yellowish-brown colour, having a pearly metallic lustre, flat cleavage, and exhibiting a slight play of colour. Is generally found in connection with serpentine; and is closely related to *Bronsite* and *Diallage*—being softer, and containing more water than the former, and more magnesia and less lime than the latter. Thus an average of analyses gives—

<i>Schiller-spar</i> ,	43 silica, 26 magn., 8 lime, 13 iron prot., 1 mangan., 2 alumina, 13 water.										
<i>Diallage</i> , 51	16	17	6	4	3	2					
<i>Bronsite</i> , 56	80	2	8	1	2						

Schist (Gr. *schisma*, a splitting or division).—This term should be restricted to such rocks as mica-schist, chlorite-schist, gneiss, and the like, which have a foliated structure, and split up in thin irregular plates, not by regular cleavage as in clay-slate, nor in large flat laminae as in flag-stones. Hence we speak of the “crystalline schists,” meaning thereby gneiss, mica-schist, chlorite-schist, and the like, as distinct from the *slates*, which in this sense are retained for the Clay-slate formation. In the *slates*, the splitting-up may be said to be perfect and indefinite; the *schists* or *schistose rocks*, on the other hand, are only capable of an imperfect separation into layers and laminae.

Schizopteris (Gr. *schiza*, a cleft, and *pterys*, fern).—An obscure genus of Coal-measure ferns, so called from their palmated or deeply-cleft leaflets. They have been found surrounding the stems of *sphenopteris*, and from this circumstance are supposed to have been climbers, and indicative of a tropical climate.

Schlérodus (Gr. *schleros*, rough, and *odous*, tooth).—A provisional genus of fishes found in the Ludlow bone-bed (Upper Silurian), and so named from the minute pustules on the surface of their teeth. The jaws and teeth are the only portions yet found.

Schorl (Swed. *shorl*, brittle).—Known also as *Black Tourmaline*, a prismatic, longitudinally-striated mineral, of a pitchy lustre and colour, brittle texture, and capable of being rendered electric by heat or friction. It occurs abundantly in the sparry cavities and veins of the granitic rocks, often beautifully imbedded in the felspar and quartz. The term *schorl* has been applied to several dissimilar minerals by foreign mineralogists, as “*schorl rouge*,” *rutile*; “*schorl blanc*,” *albite*; “*schorl violet*,” *axinite*, &c.

Sclérétinite (Gr. *skleros*, hard; *retine*, resin).—One of the mineral resins occurring in the Palæozoic Coal-formations, in roundish drops and pellets, of a black colour, hard and brittle like asphalt, but nearly allied to amber in composition.

Scolithus, **Scolites** (Gr. *skolios*, tortuous).—Applied to those tortuous tube-like markings which occur in certain sandstones, and which seem to have been the burrows of annelids, or, as some suppose, of minute fossorial crustaceans.

Scoriaceous.—Resembling *scoriae*; applied to loose, cindery debris,

having the aspect or character of scoriae. **Scorified**.—Reduced to scoriae, or cindery dross.

Scoriae (Ital. *scoria*, dross).—Applied to all accumulations of dust, ashes, cinders, and loose fragments of rocks, discharged from active volcanoes. Properly speaking, the term refers to the *scum-like dross* which floats on the surface of molten masses, and which, when cooled down, breaks up into loose cindery fragments and clinkers. We may have, thus, the scoriae of a glass-furnace as well as the scoriae of a volcano; though the term is generally applied to the cindery products of the latter.

Scoriform.—In the form of, or resembling scoriae. Applied to loose cindery aggregates, which seem to owe their origin to igneous action.

Scotch Pebbles.—A common term among mineralogists for varieties of agate, carnelian, and the like, which are often found in the soils from decomposed traps and in the gravels of rivers and the sea-shores, but which were originally derived from the cavities of the amygdaloidal rocks of Scotland.—See AMYGDALOID.

Screw-Stones.—A familiar term for the hollow siliceous casts of encrinite stems, frequently occurring in the cherts and rotten stones of the Carboniferous limestone; and so called from the resemblance of the numerous interspaces of the jointed columns to the threads of a screw.—See PULLEY-STONES.

Sea-Breeze.—In geography, the breeze or air-current that sets in from the sea towards the land. This generally occurs during the day, when the warmer air over the heated surface of the land ascends, and the colder air over the sea sets in to supply its place. Within the tropics the sea and land breezes occur with great regularity, the former from nine in the morning till near sunset, and the latter from a little after sunset till near sunrise the following morning.

Seal.—In zoology, the familiar term for a well-known genus and family (*Phocidae*) of marine carnivorous mammals frequenting our own shores, but abounding especially on the sub-arctic coasts of Newfoundland, Labrador, Greenland, and Spitzbergen, where they are hunted for their oil, and killed in incredible numbers. The seal is not known in a fossil state earlier than the close of the Glacial or Upper Pleistocene period, when apparently more than one species occur in the brick-clays of the British Islands.

Seam.—Strictly speaking, the line of separation between two strata, which often differs in colour from the strata themselves, and looks like the seam between two portions of a garment; but loosely applied to subordinate beds occurring in any series, as *seams of coal* in the Coal-measures, which are in the main composed of sandstones, shales, and clays.

Secondary Strata.—Originally applied to the fossiliferous strata lying between the Transition and Tertiary of Werner; now employed as equivalent to *Mesozoic*—that is, comprehending the Trias, Lias, Oolite, Wealden, and Chalk formations.

Sectile (Lat. *sectilis*).—Capable of being cut; applied in mineralogy to those rocks and minerals which can be cut with a knife without causing the particles to spitter and fly about. Talc, mica, and steatite yield quietly to the knife, and are thence said to be “sectile.”

Section (Lat. *sectus*, cut through).—Literally, a cutting through, as of the trunk of a tree, to display its internal structure. A geological section represents the structure of the earth's crust on any given line in a vertical direction; and is either *natural*, as seen in cliffs and precipices; *artificial*,

as in quarries, tunnels, and coal-pits; or *theoretical*, when constructed from a number of observations on the position of the strata in various adjacent localities. As the earth is so vast, compared with any means of representation we have at our command, and as the thickness of the strata is so small, compared with the length of most lines of section, "theoretical sections" are in general mere indications of what they are intended to represent, but indications of vast utility when read with proper understanding.

Sécular (Lat. *seculum*, an age).—Applied in geology to great natural processes, whose results become appreciable only after the lapse of ages: thus we speak of the "secular refrigeration" of the globe from some hypothetical state of original igneous fluidity; of "secular contraction" of the earth's mass, as resulting from its gradual refrigeration, and so on.

Sédiment (Lat. *sedere*, to settle down).—Matter settled down from suspension in water. If the turbid muddy waters of a river be allowed to stagnate, the mud will gradually fall to the bottom and form *sediment*. Rocks which have been formed in this manner, as shale, clay, sandstone, &c., are termed *sedimentary*; that is, sedimented from mechanical suspension in water. The term, however, is generally applied to all the *stratified* rocks, whether produced exactly in this way, or generally by the operations of water.

Seismógraphy, Seismográphic (Gr. *seismos*, a shock, earthquake, and *graphie*, description).—Literally a writing about or description of earthquakes; hence such accounts constitute a "seismography," and maps or charts constructed so as to indicate the centres of convulsion, lines of direction, areas of disturbance, and the like, are termed "seismographic."

Seismólogy (Gr. *seismos*, a shock or earthquake, *logos*, reasoning).—The science of earthquakes, in all that relates to their force, duration, lines of direction, periodicity, and other characteristics.

Seismómeter (Gr.).—Literally "shock-measurer;" an instrument, or rather apparatus, of which there are several modifications, for measuring the force and direction of earthquake convulsions.

Seláchia (Gr. *selas*, a flash of light).—The Cartilaginous order of fishes, as the sharks, rays, and chimaeroids; said to be so called from their emitting a phosphorescent light.—See tabulations, "ANIMAL SCHEME."

Selenite (Gr. *selene*, the moon).—Sulphate of lime or gypsum, when it occurs in fine transparent crystals; so termed from its subdued lustre and transparency.—See GYPSUM.

Selenium (Gr. *selene*, in allusion to its lustre).—An elementary acidifying and basifying substance, discovered by Berzelius in 1818 in the iron pyrites of Fahlun. In its general chemical habitudes it resembles sulphur, and is said to form a connecting link between sulphur and the metals. When precipitated it appears as a red powder, which, when heated, melts, and on cooling forms a brittle black mass, but transmitting red light in thin plates. It burns with a blue flame, and produces a gaseous substance (oxide of selenium), which has a most penetrating and characteristic odour. With sulphur, phosphorus, the earths and metals, it forms *seleniurets*; hence "seleniurets" of lead, cobalt, silver, &c.

Semi- (Lat.).—A frequent prefix in scientific compounds, literally signifying "half," but frequently implying merely defect or incompleteness; as *semicircle*, half a circle; *semi-transparent*, imperfectly transparent. Same as the Greek *hemi*—which see.

Semionótns (Gr. *semeion*, a mark or device, and *notos*, the back).—Liter-

ally "stamped back;" a genus of Liassic fishes belonging to the *Lepidoid* order; and so called by Agassiz in allusion to the peculiar character of the dorsal scales.

Semi-Opal.—Literally "half-opal;" a term applied to the duller and less pellucid varieties of common *Opal*, which see.

Seneca Oil.—A familiar term for the petroleum of Pennsylvania, from its occurrence at Seneca Creek, and its use as a lubricant by the Seneca Indians.—See PETROLEUM and BITUMEN.

Sepals (Lat. *sepes*, a fence or enclosure).—The leaf-like divisions of the cup or *calyx* which encloses the *corolla* or blossom of a flower. The impressions of *sepals* are not unfrequent in a fossil state; those of the *petals* or divisions of the blossom are exceedingly rare and doubtful.

Sepiadae (Gr. *sepie*, the cuttle-fish).—A well-known family of cephalopodous molluscs belonging to the Decapod division of the Dibranchiate order, and of which the common cuttle-fish (*Sepia officinalis*) has been taken as the type. The family is characterised by an internal rudimentary shell, in the form of a friable calcareous plate, imbedded in the back part of the mantle, and from which the *pounce* of the chemist is derived. The family includes several fossil forms—*Spirulirostra*, *Beloptera*, *Belemnosis*, &c.—See tabulations, "ANIMAL SCHEME."

Septarium, plural **Septaria** (Lat. *septum*, a fence or division).—Flattened nodules of calcareous clay, ironstone, or other matter, internally divided into numerous angular compartments by reticulating fissures which are usually filled with calcareous spar, and show well against the darker matrix of the nodule. The reticulating fissures or *septa* seem to have arisen from the shrinkage of the mass while in the act of consolidating, and to have been subsequently filled by infiltration. Such argillaceous, calcareous, and ferruginous nodules are common in many clays and marls, as in the shales of the Coal-formation, in the Oxford clay, in the London and Barton clays, &c.; are often arranged in lines or bands; are always more or less flattened; generally contain some central organic nucleus round which the matter has aggregated, such as a leaf, scale, coprolite, or the like; and when split up in the direction of the stratification, frequently exhibit very curiously marked sections; hence the names *beetle-stones*, *turtle-stones*, *Ludi Helmontii*, and the like. *Septaria*, such as those derived from the Oxford and London clays, when burnt and ground, are largely used for Roman cements.—See NODULAR STRUCTURE.

Septum, plural **Septa** (Lat.)—A partition or division. The thin plates which separate the chambers of the Nautilus and Ammonite are termed *septa*; so also the thin radiating divisions which give to the pores of corals their star-like or rayed appearance.

Seral (Lat.)—Late, the nightfall; the last or uppermost of the fifteen series into which Professor Rogers subdivides the Palaeozoic strata of the Appalachian chain—the "Nightfall," metaphorically speaking, of the North American Palaeozoics, and the equivalents of our upper or true Coal-measures.—See PALÆOZOIC FORMATIONS.

Series.—Applied to any number of allied objects arranged in sequence. In geological classification, any set of strata possessing some common mineral or fossil characteristic, as the Greensand series, Wenlock series, &c. A subordinate group in some great formation or system.

Serpentine.—A siliceo-magnesian rock of granitic or metamorphic origin; so called from the resemblance of its variegated colours to the

skin of a serpent. Common or compact serpentine occurs in veins, dykes, or imbedded masses; is usually dark-coloured (green, grey, red, or brown), and often spotted, striped, or veined; is rather soft and sectile; has a dull splintery fracture; and feels greasy. Though soft it is susceptible of a fine polish, and being easily cut and turned on the lathe, it is fashioned into various ornamental articles, as that of Lizard Point in Cornwall, and Portsoy in Banffshire. Its average composition seems to be 44 silica, 43 magnesia, and 13 water. Besides the common serpentine, also known as *ophite*, mineralogists distinguish *noble serpentine*, usually of some shade of green, translucent, and having a resinous lustre when polished; *marmolite*, or foliated serpentine; *picrolite*, or fibrous serpentine; and *chrysolite*, or asbestiform serpentine, of a fine oil-green colour and silky lustre, but considered by some as a distinct mineral.

Sérpula, Sèrpúlides.—A family and genus of annelids deriving their name from the tortuous and twisted tubes they inhabit. The animals of this family are fixed or sedentary; and have elaborate calcareous tubes or crusts for their protection. They have feathery or arborescent gills surrounding their heads; hence the occasional term Cephalobranchiate Annelidans. The shelly tubes of the *Serpula* occur on every shore, incrusting stones, rocks, shells, drift-wood, sea-weeds, &c.; and are readily distinguished by their tortuous and irregular forms. In tropical seas some species live in large colonies, their shelly exuvise forming banks resembling coral-reefs in their solidity and extent.

Sèrpulites.—The general palæontological term for all fossil tortuous tubes and tube-like organisms apparently allied to those of the existing *Serpula*; and evidently the products of tube-forming Annelids. They occur in all formations from the Silurian upwards, and in some of their forms have often been mistaken for the shells of Mollusca. Whatever their forms, they are always smooth within, have no chambers or divisions, and exhibit no traces of muscular attachment.

Sertulária (Lat. *sertum*, a wreath).—A genus of hydroid polypes, so called from their cells being arranged on the opposite sides of a fleshy or horny axis, this giving to their stems a wreath-like appearance. The Silurian *graptolites*, though similarly disposed, may have no real affinity either to the *sertularia*, *pennatulæ*, or *virgularia* of existing seas.

Sésile (Lat. *sedeo*, I sit).—Applied to animals and organisms that are closely attached to other objects, and not supported on a pedicle, foot-stalk, or stem. Thus the balanus or acorn-shell is *sésile* when compared with thelepas or goose-barnacle, which is supported on a fleshy *pedicle*; and the eyes of some crustaceans are attached to the carapace, while those of others are surmounted on movable foot-stalks. *Sésile* and *pedunculated* are thus opposing terms.

Séta, plural Sètes (Lat., bristle, bristles).—A term frequently and variously applied in natural history. In botany, the bristle-like stalk that supports the theca or seed-case of mosses; the awn or beard of grasses; the glandular points of the rose, &c. In zoology, the stiff short hairs that clothe many caterpillars and insects; the bristles that arm the rings of the earth-worm and form its points of progression; the stiff processes that cover the limbs and mandibles of many crustaceans; and the like.

Sètáceous (Lat. *seta*, a bristle).—Covered or armed with bristles; bristle-like; in form and character resembling a bristle; bristly.

Setigerous (Lat. *seta*, bristle, and *gero*, I carry).—Literally "bristle-

bearing;" applied to the organs of plants and animals that are covered or armed with short stiff processes resembling bristles.

Shale (Ger. *schalen*, to peel or shell off).—Applied to all argillaceous strata that exhibit a laminated structure, and consequently split up more or less perfectly in the direction of their bedding. *Clay*, for example, is massive or plastic and void of structure; *marl* is friable or crumbly; *shale* always exhibits some degree of lamination and fissility. Being, in fact, the solidified muds of former waters, the shales present endless varieties in point of composition, and these are usually defined as calcareous, arenaceous, bituminous, and so forth, according to the predominating or most perceptible ingredient.

Shanklin Sand.—A name occasionally given to the Lower Greensand of the Chalk formation, from its being conspicuously developed at Shanklin, in the Isle of Wight.

Shell (Sax).—Familiarly and loosely applied to any hard crust or covering; but in zoology restricted to the hard calcareous coverings of the Mollusca or Testacea. According to Brande, the mineral or hardening principle of shell is carbonate of lime nearly pure. The animal principle in the porcellaneous shells (*e. g.*, the cowries) is a small quantity of soluble gelatine; in the mother-of-pearl or nacreous shells (*e. g.*, the pearl-oyster) it is albuminous. The latter, therefore, when steeped in dilute muriatic acid, leave a membranous or cartilaginous residue; but the former are entirely soluble.

Shell-Marl.—Applied to all deposits of *marl*—that is, soft earthy deposits of lime in the bottom of fresh-water lakes and other stagnant waters—in which shells are present in notable proportion. In British shell-marls the most abundant shells are *paludina*, *lymnaea*, *planorbis*, and *cyclus*; and in less proportion *ancylus*, *unio*, and the minute cases of entomostracous crustaceans.—See **MARL**.

Shell-Mounds.—Better known, perhaps, as *Kjökken-mødding* or "kitchen-middens," which see. These mounds, composed for the most part of shells of the oyster, cockle, mussel, and other edible mollusca, are found in many places along the shores of northern Europe, and point to an early period when savage races, ignorant of the use of the metals, frequented the sea-coast and fed upon the shell-fish in question, as well as upon the native terrestrial fauna, imbedded bones of which are also not uncommon.

Shell-Sand.—On certain coasts the tide- and wave-washed sands are in a great measure composed of the broken and triturated shells of the mollusca common to the locality. To such masses the term *shell-sand* is usually applied; and where readily accessible it forms an available fertiliser.

Shingle.—Loose imperfectly-rounded stones and pebbles, as distinct from gravel and sand. The "shingle beaches" which are piled along certain portions of our coasts, and the "shingle barriers" which occur at the mouths of many rivers, are merely masses of rock debris in the process of attrition to gravel and sand.

Shoading or Shoding.—In mining, searching for fragments of ore in the gravel of a stream or valley, so as to trace from these fragments the position of the vein from which they have been derived. In general, the *shoad-stones*, or fragments of ore, become more frequent the nearer the original vein is approached.

Shoal (Sax).—In geography, any portion of the bottom of a sea, estuary,

lake, or river where the water is of little depth. Shoals or banks are usually composed of mud, sand, and gravel, which are accumulated by opposing currents or sets of the tide; and as they are much frequented by marine animals for the purposes of food or procreation, they must become in course of ages the receptacles of very heterogeneous matters—organic and inorganic.

Siderite (Gr. *sideros*, iron).—A name given to sparry iron-ore; sometimes also to cube-ore; and occasionally to a vitreous variety of quartz of an indigo or Berlin-blue colour. The prefix *sidero-* is in frequent use in mineralogy either to denote composition or iron-like aspect, as *sideromelane*, *sideritine*, &c.

Sienite, **Sienitic**, more frequently and properly **SYENITE**, which see.

Sierra (Span.)—In geography, *sierra* signifies a ridge or range of mountains, and refers to their saw-like outline; *cordillera*, on the other hand, means simply a connected mountain-chain; and *mauna*, an isolated hill or mount.

Sigillária (Lat. *sigillum*, a seal).—An extensive genus of Coal-measure stems, characterised by their furrowed or channeled surfaces, and named in allusion to the leaf-scars, which look like so many seal-impressions on the ridges or raised flutings. In *Sigillaria* the scars of the leaves are small, round, and much narrower than the ridges of the stem; while in *Favularia*, which has also a furrowed stem, the scars are square, and as broad as the ridges. *Sigillaria* occurs in great profusion and many specific forms (upwards of fifty species have been named), and of all sizes, from stems the girth of the arm to trunks several feet in diameter, and upwards of sixty feet in length. From the flattened state of many of the trunks, it appears to have been a tree of little substance, and yet many of its characters forbid the supposition of its being hollow, like the reed or cane. In many instances it is found growing *in situ*, and in whole forests; and in such instances it is always furnished with the dichotomising or forking roots, known as *stigmata*. Regarding the affinities of *sigillaria*, some would refer it to the tree-ferns, others to the palms, and some again to the coniferae; but the truth is, that while it exhibits characters touching on several existing orders, there is in reality no living family wherewith to compare it. According to M. Brongniart, who has made it the subject of a special memoir ('Archives du Muséum d'Histoire Naturelle,' 1839), "*Sigillaria* constituted a peculiar extinct family, belonging to the great division of gymnospermous dicotyledons. They were tall erect trees, with a regular and cylindrical stem, without side-branches, but dichotomous towards the summit. Their superficial bark was hard and durable, channeled longitudinally, bearing leaf-scars that are of a rounded form above and below, and angular at the sides, often oblong in relation to the stem, and having three vascular pits, one central and small, and two lateral of a large size. The internal structure bears most analogy to that of the Cycadææ, and the foliage consisted of long, linear, carinated leaves. The *Sigillariæ*, therefore, differ essentially from the arborescent cryptogams, which they somewhat approach in having scalariform vascular tissue, symmetrical and regular leaf-scars, and branchless trunks."

Silex, **Silica** (Lat. Gr. *chalix*, a pebble).—In chemical language, "the earth of flints." This important substance (we abridge and modify from Brande) constitutes the characteristic ingredient of a great variety of siliceous minerals; among which rock-crystal, quartz, chalcedony, and

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flint, may be considered as *silex* nearly pure. It also predominates in many of the rocky masses which constitute the crust of our globe, such as granite, quartz-rock, and the numerous varieties of sandstone. Although silica has none of the ordinary or more obvious acid properties, yet as it combines in definite proportion with many salifiable bases, and expels carbonic acid when fused with the carbonated alkalies, it is very commonly termed *Silicic acid*, and its various compounds have been denominated *Silicates*. When pure and colourless rock-crystal is heated red hot, and quenched in water, it becomes opaque and friable; and if in this state it be reduced to powder, it presents one form of pure silica. If in this state (in which it is perfectly insoluble in water) it be fused with three parts of carbonate of potash, it forms a glass which is soluble in water, and from this solution (formerly called *liquor of flints*) the concentrated acids throw down the silica in the form of a *gelatinous hydrate*; but if the solution be diluted, and the acid gradually added, the alkali may be perfectly neutralised without any deposition of silica, which, therefore, is thus exhibited in a very soluble state: when, however, the solution is evaporated to dryness, the silica remains in a state as insoluble as before. This solubility of hydrated silica, whilst when dry it is perfectly insoluble, may serve to explain the occasional occurrence of silica in mineral waters, and its deposition in various chalcedonic incrustations. But silica presents another very remarkable character; which is, if we reverse the above proportions, and fuse together a mixture of one part of carbonate of potash and three of powdered rock-crystal or calcined flint, we then obtain a transparent and fusible compound which is insoluble in water, and which in fact is *glass*.—See GLASS.

Siliceous (Lat. *silex*, flint).—All rocks having a flinty texture, or into whose composition *silica* enters as a notable ingredient, are said to be siliceous. Rock-crystal and quartz are the purest states in which *silex* occurs in nature; common flint is an impure variety; and chert and hornstone are still more impure admixtures.

Siliceous-Sinter (see SINTER).—A siliceous incrustation or deposit from springs holding silica in solution, like the Geysers of Iceland. It has often a mammillary surface, and exhibits internally numerous successive lines or layers of deposit. According to Klaproth, that from the Geysers consists of 98 silica, 1.50 alumina, and 0.50 iron.

Silicified (Lat. *silex*, flint, and *fio*, I am made).—Converted into flinty or siliceous matter; petrified by the infiltration of silica in a state of solution, as the silicified stems from Antigua, the desert of Cairo, and Van Diemen's Land. **Silicification** is a common process in the neighbourhood of hot springs, which generally hold a notable proportion of silica in solution—e.g., the Geysers of Iceland, and the hot springs of the Azores and of Tongariro in New Zealand.

Silicon.—The base of silica, one of the elementary substances, of a dark nut-brown colour, and now shown not to be a metal, but nearly allied to boron and carbon in some of its properties. It is a non-conductor of electricity, incombustible in air and oxygen, infusible by the blowpipe, and not acted upon by any single acid, though readily soluble in a mixture of the nitric and hydro-fluoric acids. Like carbon it will combine with the metals, especially with aluminium, forming *cast-aluminium*, just as carbon and iron form *cast-iron*.

Sill (Sax. *syl*, the flat stone forming the threshold or door-sill).—Applied

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in mining to flat-bedded strata of sandstone or similar hard rocks ; hence the "whin-sill" of the north of England—an interstratified trap of the mountain limestone.

Silt.—This term is properly applied to the fine impalpable mud which collects in lakes and estuaries, but is generally used to designate all calm and gradual deposits of mud, clay, or sand ; hence we speak of "marine silt," "tidal silt," and of harbours being partially filled or *silted up* with tidal debris.

Silurian System.—The name originally given by Sir Roderick Murchison (and now adopted by all geologists) to that vast suite of fossiliferous strata which lies between the partially fossiliferous Cambrian schists beneath and the Old Red Sandstone above, from the fact of their being well developed, and first worked out by him, in the district between England and Wales anciently inhabited by the *Silures* under their chief *Caractacus* or Caradoc. In the typical region of Shropshire, &c., the system, according to its investigator, consists of the following members :—

UPPER SILURIAN.

- | | | |
|------------------------|---|---|
| <i>Ludlow Series,</i> | { | Finely laminated reddish and greenish sandstones, locally known as "Tilestones." (In part, base of Devonian System).
Micaceous grey sandstone in beds of varying thickness.
Argillaceous limestone (Aymestry limestone).
Shale with concretions of limestone (Lower Ludlow). |
| <i>Wenlock Series,</i> | { | Concretionary limestone (Wenlock limestone).
Argillaceous shale in thick beds (Wenlock shale).
Shelly limestone and sandstone (Woolhope and Mayhill).
Gritty sandstones and shales (Upper Llandovery). |

LOWER SILURIAN.

- | | | |
|--------------------------|---|--|
| <i>Llandeilo Series,</i> | { | Grits and sandy shales (Lower Llandovery).
Thick-bedded whitish freestone (Caradoc sandstone).
Dark calcareous flags and slates (Bala beds).
Slaty flags and bands of limestone (Llandeilo and Lingula flags).
Gritty flags and slates (Longmynd or "Bottom Rocks"). |
|--------------------------|---|--|

In other regions the nature of the rocks may differ from the above ; but in all—whether Scotland, Scandinavia, Bohemia, Russia, or North America—the same facies of Life prevails, and the Silurian as a SYSTEM is distinctively characterised by its *graptolites* ; its corals, *heliolites*, *favosites*, &c. ; its echinoderms, *actinocrinites*, *cystidea*, &c. ; its brachiopods, *lingula*, *terebratula*, and *orthis* ; its chambered shells, *lituities* and *Maclurea* ; its *serpulites* and *cornulites* ; its crustacea, *calymene*, *asaphus*, *trinaucleus*, and other trilobites, most of which are never found beyond the limits of Silurian strata. Its fauna is eminently marine, and exhibits most of the great forms of invertebrate life ; but as yet few *fishes* have been detected, and these chiefly in the uppermost beds of the system. Its flora is still imperfectly known—scattered and fragmentary sea-weeds, indistinct stems of aquatic plants, and a few pinnules and spore-cases of lycopodaceous, and twigs of lepidodendroid land-plants, being all that has yet been discovered in strata unmistakably Silurian.

Silvas, Selvas (Lat. *silva*, a wood).—A term applied to the woodland region of the great Amazonian plain. Low-lying, damp, fertile in soil, and under the influences of a tropical sun, these *silvas* present the rankest luxuriance of primeval forest-growth.

Silver.—An early and well-known metal of a peculiar white colour (silver-white), brilliant lustre, malleable, ductile, and soft when pure. Its specific gravity is from 10.5 to 11; it melts at about 1000° Fahr.; it is not altered by air or moisture, but is readily tarnished or blackened by sulphuretted hydrogen. It occurs *native* in the older rocks, in threads and strings, in arborescent, moss-like aggregates, and in plates and nuggets often of considerable magnitude. In its native state it often occurs as an *alloy* with gold, platina, copper, or arsenic—more frequently perhaps with platina than with any other metal. It is also largely obtained from *ores*, generally as a *sulphuret* or *sulphide*, and often in intimate union with ores of lead, antimony, bismuth, &c.—so that the ores yielding silver are, strictly speaking, ores of other metals. These ores are found chiefly in the primary and transition strata; though argentiferous lead ores occur abundantly in secondary strata.

Simoom.—An Arabic term signifying *poison*, and applied to a hot suffocating wind, which occurs in most countries bordering on sandy deserts. Coming from the arid desert, and laden with the minutest particles, it often gives a red or reddish-dun colour to the atmosphere, and thus forewarns the traveller to take shelter from the approach of its pestilential breath. In Turkey it is called the *Sameli*; in Egypt, *Khamsia* (fifty), because it usually continues fifty days; and on the western coast of Africa, *Harmattan*.

Sinter (Ger. *sintern*, to drop).—Compact incrustations from siliceous or calcareous springs are known as *siliceous-sinter* and *calc-sinter*. The term is used in contradistinction to tuff or tufa, which is open and porous, and wants the hard ringing sound of sinter when struck by the hammer.

Siphonia (Gr.)—A genus of fossil sponges occurring abundantly in the Chalk and Greensand of Europe. The Siphonise consist of a pear-shaped body, more or less lobed, and mounted on a slender stalk, which terminates below in several rootlets for attachment to the rocks or other bodies on which they grow. Those occurring in the Upper Greensand of Farnham are infiltrated with phosphate of lime, and have (along with other phosphatic nodules from the same strata) been used in agriculture.

Siphuncle (dim. of *siphon*, a tube).—Any small tube or tubular passage; usually applied to the tube-like perforation which passes through the septa and chambers of such shells as the nautilus, ammonite, and ceratite.

Sirocco (Arab.)—The name given to the hot parching wind which occasionally passes over Sicily and adjacent districts during the latter part of summer and autumn, and which is supposed to originate in the Sahara or Great Burning Desert of Africa.

Sivalic or Sewalick Hills.—A range of minor mountains skirting the southern base of the Himalayas, and celebrated in geology chiefly through the discoveries of Dr Falconer and Colonel Sir Proby Cautley. "It has proved," says the former, "more abundant in genera and species than any other region yet explored. As a general expression of the leading features, it may be stated that it appears to have been composed of representative forms of all ages, from the oldest of the Tertiary period down to the modern, and of all the geographical divisions of the Old Continent grouped together into one comprehensive Fauna in India."

Sivathérion (*Siva*, an Indian goddess, and *therion*, beast).—The generic term applied by Dr Falconer to the skull and bones of a gigantic mammal

found in the Sivalic Tertiaries, and forming, as it were, a link between the ruminants and large pachyderms. "It was larger than a rhinoceros, had four horns, and was furnished with a proboscis; thus combining the horns of a ruminant with the characters of a pachyderm. When living it must have resembled an immense antelope or gnu, with a short and thick head, and an elevated cranium crested with two pairs of horns—the front pair being small and the hinder large, and set quite behind, as in the Aurochs. With the face and figure of the rhinoceros, it had small lateral eyes, great lips, and a nasal proboscis."—See 'Fauna Antiqua Sivalensis,' by Falconer and Cautley.

Skorodite (Gr. *skorodon*, garlic).—A hydrous arseniate of iron, of a leek-green colour, inclining to brown; and supposed to be a secondary production from the decomposition of ores containing arsenic and iron. It fuses before the blowpipe, giving out a strong smell of garlic; whence the name.

Slate (Sax.).—Any thin plate of rock; any rock that can be split (*schlitten*) into thin limæ or plates, like roofing-slate. This term is now generally, and should be, restricted to argillaceous rocks, like common roofing-slate, whose lamination is not produced by bedding, but is due to a metamorphism called *cleavage*, which often traverses the rock at right angles to the lines of stratification. Foliated rocks, like gneiss and mica-schist, are termed *schists*, not slates; and thinly-bedded sandstones are *flagstones* and *tilestones*.—See CLAY-SLATE and CLEAVAGE.

Slate-Spar.—A variety of calcareous spar; so called from its occurring in thin slaty lamellæ, often with a shining white pearly lustre, and greasy feel.—See CALO-SPAR.

Slaty.—Resembling slate; having the cleavable or fissile structure of clay-slate. Somewhat loosely applied to all hard thinly-laminated rocks; as "slate-clay" or slaty clay, a hard fissile shale; "slate-coal" or slaty coal, a hard laminated variety of bituminous coal.

Slide.—A miner's term for a minor slip or dislocation of the strata, the fissure being usually filled with fine unctuous clay, which makes the one side appear to slip or *slide* away from the other.

Slakensides.—In mining, the smooth striated surface of a fault or fissure apparently produced by convulsive friction, and subsequently coated with a siliceous or calcareous glaze by the passage of water or heated vapours. Also provincially applied to an ore of galena occurring in Derbyshire.

Slime (Sax., akin to the Lat. *limus*, mud).—The familiar as well as scientific term for all soft adhesive mud; hence the *slimy* silt of comparatively stagnant waters, the *slimy ooze* or *oozs* of the deep sea-bottom brought up by the sounding-rod.

Slip.—A familiar term for a fault or dislocation, as if the one portion of strata had *slipped* or slid away from the other.—See FAULT.

Slope and Counter-Slope.—The majority of mountain-chains present on one side a long and gentle slope, and on the other a short and rapid one—the former is termed the *slope*, the latter the counter-slope. Thus the slope of the Andes is towards the Atlantic, the counter-slope or steep side towards the Pacific.

Smaltine.—Arsenide of copper; one of the most important ores of Cobalt, being, along with cobaltine, that from which the greater part of the Smalts of commerce is derived.—See COBALT.

Smerdis (Gr.).—A genus of ctenoid fishes often occurring in shoals in the Tertiary marls of Aix in Provence. They are of small size—rarely exceed-

ing three or four inches in length—and the species are generally characterised by their dorsal fins and widely-forked tails.

Smithsonite (after the chemist Smithson).—Silicate of zinc, occurring in detached crystals, and in stalactitic, botryoidal, granular, and compact masses, of various colours, vitreous lustre, brittle, phosphorescent when rubbed, and electric by heat. Consists of 67.4 oxide of zinc, 25.1 silica, and 7.5 water.—See **KALAMINE**.

Smudge-Coal.—An English miner's term for coal that has been partially de-bituminised, or converted by contact with trap-dykes, &c., into a sort of natural coke or impure anthracite. Known also as "blind-coal," "stone-coal," and other similar provincial designations.

Snow-Blanket.—The name given by farmers and others to any considerable thickness of snow which covers the ground during winter, and helps to protect its vegetation from the severity of the frost. In continental countries, like central and northern Europe, this *blanket* is of essential service during severe and long-continued frosts in early spring.

Snow-Light or **Snow-Blink**.—The name given by voyagers and travellers in the arctic regions to the peculiar reflection that arises from fields of ice or snow. An experienced seaman, it is said, can readily distinguish by the *blink* whether the ice is newly formed, heavy, compact, or open. The blink or snow-light of field-ice is the most lucid, and is tinged with yellow; of packed ice it is pure white; ice newly formed has a greyish blink; and a deep yellow tint indicates snow on land.

Snow-Line.—That line or limit of elevation at which the air permanently attains the temperature of freezing water, and at and above which the surface is perpetually covered with snow and ice. The snow-line is, of course, highest towards the equator, and gradually descends as we approach either pole. It has also its summer and winter limits, coming lower in winter, and rising higher in summer.

Soapstone.—A soft sectile variety of steatite; so called from its soapy or saponaceous feel when rubbed between the fingers—a characteristic possessed by most magnesian minerals.—See **STEATITE**.

Soda.—The oxide or rather protoxide of sodium; one of the alkalis, obtained from the ashes of marine plants, and largely and inexhaustibly from sea-salt. Several of its compounds are well-known constituents of the earth's crust; as the muriate (*common* or *rock salt*); the carbonate (*natron*); the nitrate (*nitratine*); the sulphate (*Glauber-salt*); the borate (*borax*), &c. Its compounds also occur as notable ingredients in many rocks and minerals; *e.g.*, the feldspars and zeolites.

Sodium.—The metallic basis of soda, discovered by Davy in 1809. Sodium has a bright lustre, and a white silvery colour, with a tinge of red. It is soft and readily moulded at 60°, melts at 194°, and rises in vapour at a red heat. It is lighter than water, its specific gravity being only 0.972. It is rapidly oxidised on exposure to the air, and on being thrown into water floats about upon the surface and quickly disappears—being converted into soda, which is dissolved in the water. Its affinity for oxygen prevents its occurrence in nature as *sodium*; but the compounds of *soda* are sufficiently abundant—forming rock-masses in the solid crust, occurring in the ocean and other saline waters, entering into the composition of many rocks and minerals, being present in all marine and many land plants, and appearing likewise in the structure of the higher animals, which all instinctively swallow large quantities of its chloride.—See **SODA**.

Soil (Lat. *solum*).—The usual term for that superficial earthy covering of our planet, in which plants grow and flourish, and which we cultivate, for their artificial growth, in our fields and gardens. It is an intimate admixture of disintegrated rock-matter (clay, sand, &c.) with decomposed vegetable and animal substances; and is readily distinguishable by its dark loamy colour from the inorganic "subsoil" of clay, sand, or gravel that lies beneath. Agriculturists distinguish soils partly by their prevailing constituents, as *loamy, sandy, clayey, &c.*; and partly by their fitness for the growth of certain crops, as *turnip soils, clover soils, and the like.*

Solano (Lat. *sol*, the sun).—A hot south-west wind which occasionally visits the Spanish peninsula, and, blowing from the direction of the African deserts, is regarded as a modified *sirocco*, which see.

Solenhofen, near Aichstadt in Germany, a locality celebrated for its fine lithographic slate, which has yielded to the paleontologist many of the rarest and most perfect specimens of reptiles and mammals peculiar to the upper Oolites.

Solenites (Gr. *solen*, a tube or pipe).—A genus of Oolite stems or leaves, so called from their fistular or tubular nature. They occur in matted masses, are narrow, regularly striated, taper-pointed, and not unlike, in general aspect, the leaves of the common quill-wort, *isoetes lacustris*.

Solfatara (Ital. *solfo*, sulphur).—A volcanic fissure or other orifice from which sulphureous vapours, hot mud, and steam are emitted. Akin to the *fumaroles, hornitos, and salses* that occur in most volcanic areas.—See VOLCANOES.

Solstices (Lat. *sol*, the sun; *sto*, I stand).—The two extreme points of the sun's apparent course north and south of the equator, and where he appears to make a stand, going neither northward nor southward. These are the first points of Cancer and of Capricorn, and the two corresponding seasons of the year are known as the *Summer and Winter Solstices*.

Sombrero Guano.—Sombrero, one of the West India Islands—so called from its resemblance to a "sombrero," or low-crowned Spanish hat, and situated about 130 miles east of Porto Rico—is about two and a half miles long, one-half to three-fourths of a mile wide, and rises from 20 to 30 feet above the level of the ocean. It is a barren rock, and appears to be entirely composed of the rich phosphatic mineral known in commerce as *Sombrero Guano*. This substance imbeds numerous bones of turtles and other marine animals; and from its composition, which resembles bones deprived of their cartilage, it has been supposed (with every degree of probability) that the island was once a shoal swarming with turtles and other vertebrate animals, whose accumulated remains of ages have been cemented together, and gradually elevated above the ocean level to the present position of the island.—See OSITE.

Spalaootherium (Gr. *spalax*, mole; *therium*, beast).—A mole-like insectivorous marsupial, whose teeth and jaw-bones have been found in the Upper Oolites (Purbeck Beds) of England.

Spar (Ger. *spath*).—A mineralogical term applied to those crystals or minerals which break up into rhombs, cubes, plates, prisms, &c., with smooth cleavage faces. Hence we have calc-spar, felspar, brown-spar, Iceland-spar, and the like. The term is often used as synonymous with crystal, as "*sparry cavities*," "*sparry fissures*," &c., meaning thereby that the cavities and fissures are studded with crystals.

Spatangidae.—A tribe of fossil echinites or sea-urchins peculiar to the Chalk and Greensand, and distinguished by the following characters:—Case oblong or heart-shaped; mouth elongated transversely and destitute of proper jaws, situated in front of the centre of the base and near the anterior border; of the periphery; ventral outlet towards the posterior margin; tubercles and spines all very small. The tribe has been subdivided into *spatangus* proper (in which the ambulacra are petaloid, the external row of pores slightly elongated, and the inner rows round), *ananchytes*, *micraster*, and *holaster*, which see.

Spathic (Lat. *spatha*, a blade).—Applied in mineralogy to minerals having an even-lamellar or flatly-foliated structure.

Spáthose (Gr. *spathe*, a flower-sheath).—Occurring in broad plates or lamellæ, foliated in texture, as some varieties of gypsum, and other calcareous minerals.

Species (Lat.)—In natural history, an assemblage of individuals whose likeness to one another is sufficient to justify the conclusion that they all have sprung, or may have sprung, from a common stock. According to this notion, one species is distinguished from another species by sound definite characters, which are transmissible from generation to generation, and only liable to such unimportant changes as constitute temporary *varieties*. According to other notions, a species, if at all liable to variations, may vary indefinitely, and thus in course of time pass into an altogether new and different species.

Specific Centre.—“The term *specific centre*” (we quote the late Edward Forbes) “has been used to express that single point upon which each species had its origin, and from which its individuals become diffused. In the course of their diffusion, and during the lapse of time, the species may become extinguished in its original centre, and exist only on some one or several portions of the area over which it became diffused. Groups of the individuals of a single species may thus become isolated, and if they be placed far apart, may present the fallacious aspect of two or more centres for the same species. To get at the causes of such phenomena, we must trace the history of the species backwards in time, and inquire into its connection with the history of geological change; in other words, endeavour to connect its history in space with its history in time.”

Specular (Lat. *speculum*, a mirror).—Having a smooth brilliant surface that reflects light more or less perfectly; hence “specular iron ore,” and the like.

Speeton Clay.—A deposit frequently alluded to by English geologists. It occurs at Speeton, near Scarborough in Yorkshire, and appears by its fossils to represent the Lower Greensand of the south of England, but is exceptional in its appearance, as it consists of a dark-blue laminated bed, with nodules of clay ironstone.

Spharéda (Gr. *sphaira*, a sphere or globe).—The name given to certain vegetable organisms from the Oolite, consisting of a striated stem bearing numerous branchlets, each of which is terminated by a globular berry-like body—hence the name.

Sphærodus (Gr. *sphaira*, a sphere, and *odous*, tooth).—Literally “globe-tooth;” a genus of Oolitic fishes belonging to the *Pycnodont* family, and so called from the globular shape of their teeth.

Spheroid or **Spheroid** (Gr. *sphaira*, a sphere).—A figure having a shape nearly resembling that of a perfect sphere or globe. The earth, being

flattened at either pole to the extent of some thirteen miles, is not a perfect *sphere*, but an oblate *spheroid*. **Spheroidal**.—Having the outline or figure of a spheroid; globular.

Sphaerosiderite (Gr. *sphaira*, a globe, and *sideros*, iron).—A mineralogical term applied to the botryoidal or reniform concretions of *siderite*, or sparry carbonate of iron, in allusion to their rounded forms. The "Kidney iron-ore" of the miner.—See **SIDERITE**.

Sphaerulites (Gr. *sphaira*, sphere, and *lithos*, stone).—A genus of thick sub-conical chalk shells, externally striated, and furnished with a concentrically arranged opercular-looking upper valve. They belong to the *Hippurite* family, from which genus they differ in having only one internal longitudinal ridge, and in having the external surface roughened by irregularly raised sheathing-plates of successive growths. Same as **RADIO-LITES**, which see.

Sphenacanthus (Gr. *sphen*, a wedge, and *akantha*, a thorn or spine).—A provisional genus of ichthyodorulites or fin-spines belonging to some unknown ostracodont of the lower Coal-measure period. Occur abundantly in Scotland.

Sphenophyllum (Gr. *sphen*, *sphenos*, a wedge, and *phyllon*, leaf).—The *Rotularia* of Sternberg; a genus of Coal-measure plants having verticillate (or whorled) wedge-shaped leaves—the leaves dilating at the apex, and being furnished with dichotomous veins. From these characteristics, Dr Lindley "has scarcely any doubt that *Sphenophyllum* was one of those plants which in the ancient world represented the Pine tribe of modern floras." M. Brongniart, on the other hand, regards them as herbaceous plants related to the Marsiliaceæ or Pepper-worts.

Sphenopteris (Gr. *sphen*, a wedge, and *pteris*, fern).—A genus of fossil ferns, so named from the prevailing form of the leaflets; occurring profusely in the Carboniferous system, less abundantly in the New Red Sandstone and Oolite, and dying out in the Greensand. The genus is characterised by its twice or thrice pinnated leaves; leaflets contracted at the base, not adherent to the rachis, lobed; lower lobes largest, diverging and somewhat palmate; veins one or more strongly marked in each leaflet.

Spiculum, plural **Spicula** (Lat.).—Literally, a point or sting; in zoology the term is usually applied to those minute needle-shaped siliceous or calcareous particles which are imbedded in the fibrous mass of sponges, recent and fossil. They occur in the gelatinous sarcode or investing vital membrane of living sponges, or frequently project beyond the mass, as if intended for organs of defence. According to Owen, some of the rag-stones of the Greensand are so full of siliceous spicules as to irritate the hands of the workmen employed in quarrying them.

Spider.—Remains of the Spider order (*Arachnida*) have been found in the lower Oolites; and circumstances render it probable that they existed as early as the Carboniferous era.

Spiniferites (Lat. *spina*, a spine, and *fero*, I bear).—A term employed by Dr Mantell to designate those minute spherical bodies beset with spines, which occur in the chalk and flint, and which were at one time regarded as identical with the microscopic *xanthidia* of Ehrenberg. "The real nature of these fossils," says the author of the term, "must be regarded as still undetermined." Their prevalence in the chalk-flints, whose forms are derived from zoophytes, seems to countenance the supposition that the Spiniferites are the gemmules or early state of animals of this family; but

I have never detected any organic connection between them and the Porifera with which they are associated."

Spirifer (Lat. *spira*, a spire or coil, and *fero*, I bear).—A genus of brachiopods whose broad-hinged deeply-striated bivalves occur abundantly in Silurian, Devonian, and Carboniferous strata. The Spirifers occur in many specific forms, and are so termed from the spiral calcareous processes which in the living state supported the ciliated *brachia* or arms. These processes being internal, are only observable by carefully laying open finely-preserved specimens.

Spirolina, Spirolinite (Lat. *spira*, a coil or spire).—A genus of minute many-chambered foraminiferal organisms occurring in the Chalk; and so termed from the spiral or whorl-like termination of their crossier-like forms.

Splint or Splent Coal.—A Scotch term for a hard laminated variety of bituminous coal, intermediate in texture between cannel and common pit-coal. The name is derived from its splitting (or *splenting*) up in large flaggy or board-like laminae. The Splints form a very valuable variety—their hardness fitting them for any kind of carriage, and their "dryness" enabling them to burn open, with great heat, and without caking together.

Spongillopsis.—Literally *spongilla-like*; a genus of spongiform organisms belonging to the Permian of Germany, and so named by Dr Geinitz from their near alliance to the living *Spongilla fluviatilis*, or fresh-water sponge of Blainville.

Spongitæ.—This term, says Mantell, is applied generically to those fossils which appear to be identical in structure with the ordinary marine sponges that consist of a fibro-reticulated porous mass, destitute of regular tubes or canals; the form exceedingly various. In the living sponge, the mass consists of a framework of horny interlacing fibres, in which are imbedded numerous "spicula" or needle-shaped calcareous or siliceous particles, the whole being invested by a glairy gelatinous "sarcode" or vital membrane. The outer surface is studded with "pores" which imbibe water, and convey it by numerous "canals" to the interior, whence it is ejected by larger and more prominent orifices termed "oscula." Existing sponges are usually divided into the *horny, flinty, or limy*—or "ceratose," "siliceous," and "calcareous"—according to the substance of their hard sustaining parts, which are commonly "spicules." The siliceous abound in the Oolite and Chalk, attaining their maximum of development in the latter formation; and are now almost extinct, or are represented by other families with calcareous spicula. The horny, on the other hand, appear to be more abundant now than in ancient seas—but their remains are only recognisable in those instances where they were charged with siliceous spicula.

Spoondrift.—During storms at sea, the violence of the tempest is sometimes so intense as to quell the billows, and scatter the water in a heavy shower, called by the sailors *spoondrift*. On such occasions saline particles have impregnated the air to the distance of fifty miles inland.

Spore, Sporeule (Gr. *spora*, seed).—The reproductive germ of cryptogamic plants, as the ferns and club-mosses. Such spora are often found attached to their fronds, as in the Devonian *Cyclopteris Hibernica*; or in drifted masses as in the Coal-measures; and even (according to Dr Hooker) as early as the Ludlow rocks of the Upper Silurian era.

Springs.—In geography, discharges of water from the earth's crust, and

so called from their "springing," as it were, from below to the surface. They are usually distinguished as *perennial* and *intermittent*, *surface* and *deep-seated*, *hot* and *cold*, *pure* and *mineral*, and so forth, according to their more obvious characteristics. As geographical agents they are of vast importance in administering to the wants of vegetable and animal life, and in fertilising the districts through which they flow; and as geological, they are ever dissolving and transporting mineral matter, and are intimately connected with the formation of veins, crystallisation, and the metamorphism of rock-masses.

Squaloid (*squalus*, shark, and *eidos*, like).—Shark-like; resembling, appertaining to, or having something in common with, the Shark family. The Squaloids embrace the *True sharks* or *Squalodonts*, having sharp-edged teeth and the mouth on the under surface of the head; the *Hybodonts*, having teeth nearly like the preceding, but with edges less acute; and the *Cestracionts*, having a rough pavement of bony and usually enamelled pieces in the mouth, and the mouth situated at the extremity of the head, like the cestracion or "Port-Jackson" shark of Australia.

Squamous, Squamose (Lat. *squama*, a scale).—Scaly; covered with scales; having a scale-like aspect, structure, or arrangement.

Staarenstein (Ger.).—Literally "star-stone;" the popular German designation of *Psarolites* or silicified fern-stems, in allusion to the star-like markings produced by sections of the vessels that compose their tissues.—See *PSAROLITES*.

Stahlstein, Steelstone.—The German name for some pure crystalline carbonates of iron, because a kind of steel is readily made from such ores without passing through the process of cementation. Such carbonates, though rare in Britain, abound in some parts of Europe.

Stalactite (Gr. *stalasso*, I drop).—Applied to those icicle-like incrustations of lime, chaledony, &c., which often fret the roofs of caverns and fissures, and which arise from the dropping of water holding these rock-matters in solution.

Stalagmite (Gr. *stalagma*, a drop).—The same mineral matter as *stalactite*, but applied to the incrustation that covers the floor of the cavern. The stalactites and stalagmites frequently meet each other, and form pillar-like masses in limestone caverns; and occasionally a linear fissure in the roof, by the direction it gives to the dropping of the lapidifying water, forms a perfectly transparent curtain or partition of purest alabaster.

Stalagmitic.—Having the texture or structure of stalagmite. Applied to limestones which, like those of the Tertiary fresh-water basins of Auvergne, have an open, porous, and somewhat concretionary structure.

Stanniferous (Lat. *stannum*, tin).—Yielding or containing tin; applied to veins, rocks, and superficial deposits containing the ores of tin; hence we have "stanniferous gravels," as well as "stanniferous vein-stones."

Station.—The region occupied by any particular plant is called its *station*, and that of any particular animal its *habitat*—each being the locality which presents the conditions most favourable to its growth and development.

Stéatite (Gr. *stear*, fat).—A soft magnesian or talcose mineral having a smooth, soapy, or greasy feel; hence the name. It is a mere massive talc or talc-stone, occurring in subordinate beds in serpentine and chlorite-schist; usually of a greyish or yellowish-green colour; having a fibro-laminated texture; soft and easily sectile. *Soapstone*, *potstone*, and other

talcoose rocks (silicates of magnesia), are mere varieties. Steatite has been recently employed in France in the manufacture of buttons, cameos, &c., by exposing it after its fabrication for several hours to a white heat. By this strong calcination it acquires sufficient hardness to strike fire with steel, and to resist the hardest file. It can be polished, however, with emery, tripoli, &c., and may likewise be coloured by different organic and mineral substances.

Stegodon (Gr. *stega*, roof, and *odous*, tooth).—One of the sub-genera into which Dr Falconer divides the Elephants, fossil and existing. The term has reference to the gable-end form presented by a section of their molars taken longitudinally through the ridges of the crowns. "The Stegodons" (Dr Falconer in 'Geological Journal,' vol. xiii.) "constitute the intermediate group of the Proboscidea, from which the other species diverge, through their dental characters, on the one side into the Mastodons, and on the other into the typical Elephants."

Stellated (Lat. *stella*, a star).—Star-like; having the fibres, crystals, or other members diverging in all directions from a common centre.

Stemples.—In Derbyshire, says Professor Jukes, the shafts of the vein mines are often ascended and descended, not by ladders, but by pieces of wood, called *stemples*, fixed in the side of the shaft.

Stenosaurus (Gr. *stenos*, narrow, and *sauros*, lizard).—A genus of Crocodilians found in the Chalk and Greensand, and characterised by their long, narrow, beak-like muzzles; whence the name. They are closely allied to *Teleosaurus*, but differ in the nasal orifices (which are situated at the extreme tip of the muzzle) being semicircular instead of widely-circular.

Stephanite.—Sulphide of silver and antimony; a brittle sulphuret of silver, occurring principally in veins in the older rocks, either in crystals, massive, or disseminated. It is a valuable ore of silver; consists of 70.4 silver, 14 antimony, and 15.6 sulphur; and is named after the Archduke Stephan of Austria.

Steppe Limestone.—A Pliocene limestone of brackish-water origin, and so named by Sir R. Murchison and M. de Verneuil, because, with its associated sandy beds, it underlies large areas of the steppes of eastern Europe and Asia.—See ARALO-CASPIAN FORMATION.

Steppes.—A Tartar term, adopted by geographers for those extensive flats or plains which occupy so large a portion of northern Asia and Siberia. In summer they are largely covered with long rough grass, are but partially wooded, and consist of alluvial deposits (sand, gravel, black-earth, bog-earth, &c.), all of comparatively recent formation. Though the Steppes form the great pasture-grounds of the nomade Tartars, they are in many parts barren and shingly, and in others so flat and boggy that during winter these portions become frozen and inhospitable morasses.

Stereodus (Gr. *stereo*, solid; *odous*, tooth).—Literally "solid-tooth;" a provisional genus of cycloid fishes with "sauroid" dentition, from the Miocene Tertiaries of Malta. In this genus, which somewhat resembles *pachyrhizodus* in the circular scales covered with minute asperities, the teeth are rounder, more strongly conical, and set more widely apart, with a slight curvature towards the inner side of the jaw.

Sternbergia (after Sternberg).—An assemblage of singular stems occurring in the sandstones of the Coal-measures, and presenting the appearance of a vast number of plates or short joints held together by a central

axis. Some of them are striated longitudinally, others not; and many are evidently the detached central piths of other plants, and not independent stems.

Sternum (Lat.)—The breast-bone; whose form in most vertebrate families is a good anatomical criterion. **Sternal**.—Of or belonging to the breast. **Sterno-costal**.—Belonging to the region of the ribs attached to the sternum.

Stibnite (Lat. *stibium*, antimony).—Tersulphide of antimony, consisting of 72.88 antimony, and 27.12 sulphur. "This ore (we quote the 'Glossary of Mineralogy') usually occurs crystallised in variously modified and terminated rhombic prisms, which are sometimes closely aggregated laterally; also disseminated; massive, with a long columnar structure; and fibrous, with a plumose, woolly, or felt-like appearance. Colour and streak lead-grey, inclining to steel-grey; sometimes blackish and dull externally, and with an iridescent tarnish. Lustre, metallic, sectile; very brittle; yields to the pressure of the nail; and leaves a mark like black-lead when rubbed on paper." This ore is the source of most of the antimony of commerce; and may be distinguished from a similar ore of manganese by its easy fusibility, crude antimony being obtained from it by simple fusion.—See **ANTIMONY**.

Stigmária (Lat. *stigma*, a dot or puncture).—An extensive assemblage of root-stems, characteristic of and peculiar to the Carboniferous system, and so named from their regularly pitted or dotted surfaces—each puncture or areola representing the attachment of a long, slender, succulent radicle. For a long time the true nature of *stigmária* was unknown, and as there is nothing analogous in existing nature, the earlier observers busied themselves with ingenious speculations, which ended only in a name; hence the numerous designations—*floodites*, *variolaria*, *phytolithus*, *lithophyllum*, &c.—by which the organism has been successively known. *Stigmária* is now ascertained to be the root of *sigillaria*, *lepidodendron*, &c., and usually occurs in the shale or ancient mud in which it grew, as an underground stem less or more cylindrical, generally compressed, studded with circular pittings or areolæ arranged in spiral order round the stem; these areolæ often denuded, but frequently having the long succulent tubular radicals attached. In most instances the main roots have central or sub-central piths, or woody axes, and where the matrix is sufficiently preservative, a thick finely-corrugated bark makes its appearance—though generally converted into a film of coal. When found in attachment with the *sigillaria* trunk, four or more main roots strike down into the soil, these speedily bifurcate and spread out horizontally, bifurcating again and again, till they terminate at a distance (often of 20 or 30 feet) in an obtuse-growing point. Where the underground root and aerial stem meet, the peculiar markings both of *stigmária* and *sigillaria* are usually indistinct, and it is not till beyond the first bifurcation that the regular areolæ and their attached radicles make their appearance. As there are several species of *sigillaria* and *lepidodendron*, so we are presented with several *stigmária*—the specific distinctions consisting chiefly in the forms of the areolæ and the attached radicles. In some the areolæ are distinctly stellate or star-shaped; in others they are so elevated as to become tubercular (hence Brongniart's term *mammillaria*); and in all there is a central speck which passes inwards and connects the succulent radicle with the central woody axis.

Stilbite (Gr. *stilbe*, lustre).—A mineral of the Zeolite family occurring in fissures or druses of granite and primary rocks, but most frequently in traps and amygdaloids. Occurs in broad pyramidal crystals, often in fascicular or diverging groups; also massive, in radiating broad columnar aggregates; or maced. Has a vitreous lustre; is colourless, or more frequently white, red, grey, yellow, and brown. Consists of silica 55.07, alumina 16.58, lime 7.58, soda 1.30, and water 19.30.

Stinkstone (Ger. *stinkstein*).—A name given to fetid limestones—that is, those which, on being struck or rubbed, emit an odour of sulphuretted hydrogen. They are usually of a dark colour, and are often less or more bituminous. Known also as *Swinestone*.

Stiper Stones.—A celebrated ridge in Shropshire, whose stony masses, says Murchison, “appear to the artist like insulated Cyclopean ruins jutting out upon a lofty moorland, at heights varying from 1500 to 1600 feet above the sea.” They are fragments of a thick band of siliceous sandstones, which, though in parts veined, altered, and fractured, and occasionally passing into crystalline quartz rock, yet form an integral portion of the overlying schistose formation, and contain fragments of lingulae. They belong to the Primordial or Protozoic Zone of palaeontologists.—See SILURIAN SYSTEM.

Stomáпода (Gr. *stoma*, the mouth, and *pous, podos*, the foot).—An order of Crustaceans, so called from the arrangement of their thoracic or true feet in connection with the mouth, which is usually furnished with one or more pairs of jaw-feet—the whole of the thoracic segments being covered or enclosed by the carapace. It includes three families, the *Phyllosomida*, the *Squillida*, and the *Mysida*.

Stone Lilies.—A popular term for the *Encrinites*, in allusion to the resemblance which their rayed receptacles mounted on slender columns bear to the flower and stalk of the lily (Gr. *krison*, a lily).

Stonesfield Slate.—A member of the lower Oolites, occurring immediately beneath what is known as the “Great Oolite,” and celebrated for its being the rock in which English geologists first detected mammalian remains (*Phascolotherium*, &c.) of Secondary epoch. It is a thin calcareous flagstone occurring in two beds, separated by a calcareous sandstone, and is worked for pavement and tiles near the village of Stonesfield in Oxfordshire.

Stourbridge Clay.—A celebrated fireclay occurring in the Coal-measures of Stourbridge in Worcestershire, and largely employed in the manufacture of fire-bricks, pipes, retorts, furnaces, and the like. It is found in a bed about 4 feet thick, and consists of about 64 silica, 23 alumina, 2 oxide of iron, and 10 water.

Strahlstein (Ger.).—Literally “ray-stone;” the German synonyme of *Actinote* or *Actinolite* (which see). A variety or sub-species of Hornblende, so called from its occurring in long prismatic crystals, or in radiated columnar masses.

Stratification (Lat. *stratum*, and *facio*, I make).—The general arrangement or condition of all rocks or other matters deposited from suspension in water—this arrangement being in layers or strata more or less horizontal and parallel to each other. Inclined, vertical, or contorted stratification is the result of convulsions subsequent to the deposition and consolidation of the originally flat strata, and though altering their position, does not affect their character as *stratified* masses. Stratification is thus

a mere mechanical arrangement, and not to be confounded with jointing, cleavage, foliation, crystallisation, or other structure arising from the action of chemical or other subtle forces. What is termed "*false stratification*" (that is, when a thick stratum is made up of minor layers, either placed obliquely, waving, or thinning out and thickening irregularly) is a structure arising from currents in the water of deposit—the sedimentary matter being here and there shifted and redeposited, being carried over the sloping edges of submarine banks, layer after layer, or, it may be, blown about and redistributed in minor layers, as we see in sub-aërial sand-hills, or on the shifting banks of rivers and tidal estuaries.—See LAMINATION.

Stratum, plural **Strata** (Lat. *stratum*, strewn or spread out).—When rocks lie in layers, one above another, each layer forms a *stratum*, the whole a series of *strata*. The term evidently implies the idea of being strewn or spread out by some smoothing, levelling, or equalising action, as that of water. Rocks lying in parallel layers are said to be *stratified*; those among which there is no appearance of this arrangement, *unstratified*. Layer, bed, seam, band, &c., are less or more used as synonymous with stratum; but strictly speaking, each has its own proper significance in correct geological description.

Streak.—In mineralogy, that appearance which the surface of a mineral presents when scratched by a hard instrument; or that appearance which a mineral leaves on a rough porcelain slab when forcibly drawn or stroked along its surface. The *streak*, often differing from the colour, and being pretty persistent, supplies the mineralogist with an easily applied physical characteristic.

Stream-Tin.—A term applied to the rolled fragments of tin-stone or oxide of tin, which occur mingled with gravel and other stony detritus in the gullies and water-courses of Cornwall.—See TIN-STONE.

Stream-Works.—The usual designation for metalliferous workings in the loose clays, sands, gravels, and general "drift" which covers the valleys of a country, and from which the metal or ore is obtained by repeated "washings," in contradistinction to "mine-works," which are carried on in the veins that traverse the solid rocks. These metalliferous drifts are but the debris worn down in course of ages from the veins of the higher hills.

Streptospondylus (Gr. *streptos*, turned back or reversed, and *spondylos*, vertebra).—A crocodilian saurian of the Wealden epoch, so called in allusion to the peculiar articulating surfaces of the vertebrae. In existing crocodiles the bones of the back or vertebrae are *concavo-convex*, that is, united to each other by a ball-and-socket joint, the convexity being behind. Some of the fossil crocodiles of the Tertiary have also this structure of the spinal column; but in every crocodilian of the Secondary formations the articulating surfaces of the vertebrae are either flat or concave, except in the *streptospondylus*, whose vertebrae are *convexo-concave*; that is, the convexity is directed forwards—a position the reverse of the ordinary type.

Striated (Lat. *stria*, a streak).—Streaked or marked with fine thread-like lines running parallel to each other. When the striae become very marked and decided, the surfaces are said to be *grooved*, *furrowed*, or *channeled*.

Strike (Ger. *streichen*, to stretch or extend).—The direction or line of outcrop of any stratum. The strike of a stratum is always at right angles to its dip, and *vice versâ*. Thus, if the strike of a stratum run east and

west, it must dip either to the north or south; or if we find any stratum dipping to the east, we may be sure that its outcrop has a north and south direction.

String.—In mining, a small narrow branch of a metalliferous vein; hence certain ores are spoken of as occurring in “threads and strings.”

Strobilites (Gr. *strobilos*, a fir-cone).—A generic term for certain coniferous cones, with tapering truncated scales, occurring in the Coal, Lias, and other formations. The term may be held, in the mean time, for the reception of all fossil fruits that are evidently coniferous.

Stromatolgy (Gr. *stroma*, stratum).—A term proposed to embrace “the history of the formation of the stratified rocks,” with all that relates to their succession and organic remains, in contradistinction to PETROLOGY and LITHOLOGY, which see.

Strömnnite.—Known also as *Barystrontianite*; a variety of Strontianite or carbonate of strontian, so called from Stromness in Orkney, where it occurs in yellowish-white, semi-translucent masses, with a faint pearly lustre and crystalline structure. Consists of 68.6 carbonate of strontian, 27.5 sulphate of baryta, and 2.6 carbonate of lime. Supposed to be a mere admixture of strontianite and barytes.

Strongylóceros (Gr. *strongylos*, rounded, and *keras*, horn).—A species of gigantic deer, found in Pleistocene Tertiaries and bone-caves, rivalling the *megaceros*, or gigantic Irish deer, in bulk; but having, as the name indicates, antlers not palmated, but of the type of the existing red-deer.

Strontia, Strontian, Strontites.—One of the alkaline earths of which strontium is the metallic base. It occurs in a crystalline state, as a carbonate (strontianite) in the lead-mines of Strontian in Argyllshire, whence the name. It was discovered by Dr Hope in 1792; but has since been found in other countries, though strontitic minerals are rather rare. It is a greyish-white powder, infusible in the furnace; nearly as heavy as baryta; has an acid burning taste, but not so corrosive as baryta. *Strontianite* is the carbonate, and *celestine* the sulphate, of strontia, which see.

Strontianite.—Carbonate of strontia, so called because first found at Strontian in Argyllshire. It occurs in variously-modified hexahedral prisms; also in fibrous, globular, and granular masses; colour apple-green, white, and yellowish-brown; lustre shining, pearly; streak white, yields readily to the nail, and brittle, with uneven fracture. Usually consists of about 94 carbonate of strontia, 6 carbonate of lime, with a small trace of iron.

Strontium.—The metallic base of strontia, procured from the carbonate of strontia (strontianite) by Davy in 1806. It is analogous to barium, but has less lustre; is fused with difficulty, and is not volatile. When exposed to the air it attracts oxygen, and becomes converted into strontia or protoxide of strontian. Strontium is harmless, while barium and all its compounds are poisonous.

Stróphodus (Gr. *strophao*, I twist, and *odous*, tooth).—A genus of large flat, oblong cestraciant fish-teeth, much resembling *Psammodus*, but having a twisted instead of a punctated or sandy appearance on the grinding surfaces. They are common in the Lias, Oolite, and Chalk.

Structure.—A term applied in geology and mineralogy to denote the form or condition in which the component parts of rock-masses are arranged. Thus we say that certain sandstones have a fissile or laminated structure, that certain basalts have a columnar structure, and that the

structure of granite is tabular or cuboidal. *Structure*, in fact, refers to the mode in which a rock is aggregated in the mass; *texture*, on the other hand, refers to the manner in which its component particles are internally arranged. Thus, on examining a granite quarry, we find the rock arranged in large tabular or square-like masses—this is its structure; on breaking one of these blocks we find it hard, close-grained, and crystalline—this is its texture.

Stucco (Ital.)—When the white powder of calcined gypsum (plaster-of-Paris) is mixed with thin glue instead of water, it forms *stucco*, which is extensively used for casts, mouldings, statuettes, &c.

Stufa.—An Icelandic term for those fissures or orifices in volcanic districts (like Hecla), from which jets of steam issue often at a temperature much above the boiling-point of water.

Stylastrites (Gr. *stylos*, a column, and *astron*, star).—Literally “column-stars;” the name suggested by Mr Martin of Derbyshire for the *Encrinurites*, in allusion to their form, which is that of a feathery star-fish surmounted on a long jointed stalk or column. The term was rarely or never used, and may now be regarded as obsolete.

Stylonurus (Gr. *stylos*, a writing-style, and *oura*, the tail).—A genus of Crustaceans occurring in the passage-beds between the Upper Silurian and Lower Old Red Sandstone, and exhibiting forms intermediate between the xiphosurous and phyllopod families. They belong to the family *Eurypteridae*; have the cephalo-thorax much rounded; the eyes centrical or sub-centrical; are furnished with four or five pairs of organs for swimming and prehension; those organs springing from the basal joint of the jaw-feet are long and slender in the two swimming pairs, and short and covered with spines in the prehensile pairs. The thoracic-abdominal segments (twelve in number) are destitute of appendages, and the last terminates in a long caniculated pointed (or style-like) tail; hence the name. The only specimens yet discovered are from the Upper Silurian beds of Lesmahagow, and the flagstone beds of the Old Red in Forfarshire.

Stythe (Sax.)—A miner’s term for fire-damp, or rather for the stifling, suffocating odour of choke-damp that follows an explosion of the former.

Sub. (Lat. *sub*, under).—In geology, as in other branches of natural science, the prefix *sub* is employed to denote a less or inferior degree; as sub-crystalline, less than crystalline; sub-columnar, not distinctly columnar; sub-calcareous, somewhat calcareous. It also applies to position, as sub-cretaceous, under the chalk; sub-aqueous, under the water; sub-aërial, under the open air, &c.

Sub-aërial.—Literally “under the air;” applied to phenomena which take place on the earth’s surface or under the open air, in contradistinction to *sub-aqueous*, or under the water.

Sub-aqueous (Lat. *sub*, under; *aqua*, water).—Applied to phenomena that take place in or under the water, in contradistinction to *sub-aërial*, or those that take place under the open air.

Sub-Apennines.—An extensive suite of Older and Newer Pliocene beds, which are amply developed along the whole extent of Italy on both flanks of the Apennines, and form a line of low hills between the older chain and the sea. They consist of light-brown and blue marls, covered by yellow calcareous sand and gravel, and frequently attain a thickness of from 1500 to 2000 feet. They were first described by Brocchi under the term “Sub-Apennines;” and though chiefly composed of Older Pliocene strata, the

numerous shells they contain demonstrate that they belong in part both to older and newer members of the Tertiary series.

Submarine (Lat. *sub*, under, and *mare*, the sea).—Under the sea; applied to objects that have their place at some depth in the waters of the sea, at the bottom of the ocean, or covered by the waters of the ocean; as “submarine forests,” “submarine volcanoes,” and other analogous phenomena.

Submersion (Lat. *submergo*, I plunge under water).—Applied in geology to all sinkings of the land whereby its surface is brought under the waters of the ocean. Thus we have “submerged forests,” “submerged islands,” and so forth.

Subsidence (Lat. *sub*, under, and *sido*, I sink or settle down).—The act of sinking or settling down to a lower level. Applied in geology to sinkings of portions of the earth's crust, which may be either gradual and scarcely perceptible over a long lapse of years, or sudden and destructive as arising from earthquake convulsions.

Subterranean, Subterraneous (Lat. *sub* and *terra*).—Lying under the surface of the earth; imbedded at some depth in the earth, as *subterranean forests*; concealed beneath the surface of the earth, as *subterranean passages*, &c.

Subterposition (Lat. *subter*, under, and *positus*, placed).—The order of arrangement in which strata are placed below each other, as *super*-position is the order in which they are arranged above one another.

Suchosaurus (from *sucus* or *suchis*, the name given by Strabo to the sacred crocodile of the Nile).—A provisional genus of Crocodilians founded on certain teeth occurring in the Wealden strata of Tilgate Forest, and distinguished by their form, which is about an inch long, slender, pointed, gently recurved, and compressed laterally with a sharp edge in front and behind.

Sugar Limestone.—A local term, applied in Yorkshire to the metamorphosed mountain limestone that rests on the thick trappean mass of the “Whin Sill.” “It is in fact,” says Phillips, “converted to a crystalline white rock of very large grain, which easily disintegrates into loose crystalline sand.”

Sulcated (Lat. *sulcus*, a furrow).—Furrowed; deeply furrowed or channeled; having a deeply-furrowed surface.

Sulphur (Lat.).—One of the elementary substances, occurring in nature as a greenish-yellow, brittle solid; crystalline in structure, and exhaling a peculiar odour when rubbed. It has a specific gravity of from 1.98 to 2.12; is insoluble in water, but dissolves in other liquids, as oil of turpentine and the fixed oils, and especially in the bisulphuret of carbon. It is a non-conductor of electricity, but acquires negative electricity by friction. It melts at a low temperature (234°); and burns with a bluish flame and most suffocating odour. Sulphur occurs abundantly in a free state, chiefly in volcanic districts, where it appears in veins, amorphous masses, in drusy cavities, or mingled with clay and other earthy impurities. It is also extensively diffused throughout the globe in combination with other substances. With the metals it forms their principal ores, as *sulphurets* or *sulphides* of silver, lead, zinc, antimony, iron, &c.; and with the earths, as *sulphates* of lime or gypsum, of baryta, magnesia, soda, and the like. It is largely diffused throughout the waters of the ocean in combination with soda, magnesia, &c.; and is present in the structure both of plants

and animals. It is largely and variously employed in the arts, for which it is obtained from volcanic districts in a crude state; from deposits such as those of Poland and Galicia, where it occurs as an ore in combination with clay; or from pyrites, in which it is in chemical union as a sulphuret of iron.

Sump.—In coal-mining, that portion of the shaft or pit which extends downwards beyond the seam to be worked, and consequently forms the receptacle to which the waters of the mine flow, and from which it is pumped by the engine. The “sump” may vary from a few feet to several fathoms in depth.

Sunstone.—A familiar term for *Avanturine felspar*; a resplendent variety of Oligoclase, deriving its play of colours from minute imbedded flakes or crystals of iron-glance.

Superficies, Superficial (Lat.).—The external surface of any body; the exterior parts; hence the term “Superficial Accumulations” is applied to those loose and irregular accumulations of soil, sand, gravel, clay, peat-moss, and other detritus, which cover the solid and regularly stratified crust of the earth.—See tabulations, “GEOLOGICAL SCHEME.”

Superposition (Lat. *super*, above, and *positus*, placed).—The order of arrangement in which strata and formations are placed above each other. Thus, we speak of the Chalk occurring above the Oolite “in order of superposition,” and of the Muschelkalk being in order of superposition above the Bunter-Sandstein. The idea intended to be conveyed is, that every formation is more recent than that on which it lies, and that there is a certain sequence of formations which is never reversed or found out of order, though occasionally some of the members may be absent or wanting in certain localities.

Supra- (Lat. *supra*, above).—A prefix occasionally made use of to denote mere position *above*; as SUPRA-CRETACEOUS, above the Chalk,—a term employed by Sir H. de la Beche to embrace all the stratified deposits which occur above the Chalk, and equivalent to TERTIARY, which is now universally adopted.

Surbed.—In architecture, to set stones on edge, or contrary to their natural bedding in the quarry. Many stones, when *surbedded*, yield to the weather, and fall off in thin plates or laminae.

Surf.—The name given to the “broken water” of waves that roll and break on comparatively flat shores. The surf along certain shores in the southern hemisphere is often very violent and almost incessant.

Surgent (Lat.).—Mounting up; the fifth of the fifteen series into which Professor Rogers subdivides the Palaeozoic strata of the Appalachian chain—the “Mounting Day” of the North American Palaeozoics, and the equivalent in part of our Middle Silurians.—See PALAEZOIC FORMATIONS.

Surtur-Brand.—An Icelandic term for a peat-like variety of brown-coal or lignite occurring in the Pliocene deposits, and sometimes under the volcanic overflows of that island.

Sussex Marble.—A fresh-water limestone of the Wealden formation, occurring in thin bands in various parts of Sussex (whence the name), and almost wholly composed of the shells of *Paludina*, or river-snails. Known also as *Petworth Marble*, which see; and occasionally also as *Behersden Marble*, from its occurring in that locality in the Wealds of Kent.

Suture (Lat. *sutura*, a seam; from *suo*, I sew).—A seam; a line of junction. Applied in anatomy to the lines of junction between the several

portions of the cranium—these lines presenting a jagged or zigzag appearance like the cross stitches of a seam.—**Sutural** junctions are common in the hard structures of animals; *e.g.*, the bones of the head, the chambers of cephalopod shells, &c.

Swamp.—In geography, low, spongy land—generally saturated with moisture, and unfit either for agricultural or pastoral purposes. The term is commonly used as synonymous with bog and morass; but a swamp may be here and there studded with trees, like the Dismal Swamp of Florida, while bogs and marshes are destitute of trees, though frequently covered with grasses and aquatic vegetation.

Swamp Ore.—A familiar term for bog-iron ore, which occurs in swampy tracts, in bands or cakes of considerable thickness, but of inferior quality as an ore, from its containing phosphoric acid, which renders the iron made from it brittle or of slender tenacity.

Swanage Crocodile.—The popular term for the *Goniopholis*, whose remains were first discovered in the Purbeck beds of Swanage.—See **GONIOPHOLIS**.

Swinestone.—The name given by Kirwan to those fetid varieties of limestone better known as **STINKSTONE**, which see.

Syenite (from *Syene* in Upper Egypt).—A granitic rock composed of felspar, quartz, and hornblende; and so called from its being obtained by the ancient Egyptians for their monumental purposes from Syene. Any granitic rock in which hornblende predominates is termed *syenitic*, as syenitic or primitive greenstone.

Syëpoorite.—A sulphuret of cobalt, of a steel-grey or yellowish colour, found in primary rocks along with pyrite and chalcopyrite at Syëpoor, near Rajpootanah, in North-West India. It consists of 64.64 cobalt, and 35.36 sulphur; and is employed by the Indian jewellers to give a rose colour to gold.

Sylvanite.—The name originally given to native Tellurium, from its being first found in Transylvania. Also a valuable ore of gold and silver—the telluride of gold and silver—consisting of 13.8 silver, 20.5 gold, and 59.7 tellurium, with traces of copper, lead, and antimony. It is found in veins in the older rocks, and occurs in indistinct and minute circular crystals, of a steel-grey or brass-yellow colour, metallic lustre, soft, and very sectile.

Sýnchronal, Synchronous (Gr. *syn*, together, and *chronos*, time).—Occurring at the same time; contemporaneous; of the same date or epoch.

Sýncline, Synclinal (Gr. *syn*, together, and *clino*, I bend).—Applied to strata that dip from opposite directions inwards, like the leaves of a half-opened book; or which incline to a common centre, forming a trough or basin-shaped hollow. *Synclinal axis*, the line of direction in which such a trough or basin trends; the converse of *Anticlinal axis*, which see.

Syringodéndron (Gr. *syrinx*, a pipe or channel, and *dendron*, tree).—The generic term applied by Sternberg to the *Sigillaria* (which see), in allusion to the channeled or pipe-like flutings of its trunk.

Syringopóra (Gr. *syrinx*, a pipe, and *póra*, pore).—Literally “pipe-pore;” a genus of paleozoic corals abounding in the Carboniferous limestone, and bearing a general resemblance to the Organ-pipe Coral of Australian seas. The polypidom consists of a cluster of long, cylindrical, vertical tubes, distant from each other, and connected by transverse

tubular processes; the cells are deep and radiated by numerous lamellæ. Formerly known as *Tubipora* or *Tubiporites*.

System (Gr. *syn*, together, and *stemi*, to stand).—Groups of objects or occurrences, having such relations as permit them to be classed together, constitute a system. In geology, the term is usually applied to such series or groups of strata as are in intimate relation, chronologically speaking, and are characterised in the main by a marked similarity of fossil forms. Thus the various groups—Lower Coal, Mountain Limestone, Millstone Grit, and Upper Coal—which compose the *Carboniferous System*, though each lithologically very distinct, are yet intimately connected in unbroken sequence; and though each has forms of life peculiar to itself, yet over the whole there runs such a *facies* of resemblance that there can be no doubt of their all belonging to one great Life period or System.

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Tábasheer (Persic).—Literally “bamboo milk;” a siliceous secretion occurring at the joints of the bamboo, and so called from its being occasionally found of a white milky consistence. It occurs more frequently in starch-like concretions (called by the Indians “bamboo camphor”), and is a pure silex, like the thin pellicle which forms the outer coating of the bamboo and many of the grasses.

Table-Land.—In geography, any flat or comparatively level tract of land considerably elevated above the general surface of a country. While *plains* and *valleys* are low-lying expanses but little broken by elevations and depressions, *table-lands* and *plateaux* are similar tracts, often of great altitude; as the table-land of Mexico, rising about 6000 feet above the sea; the table-land of Central Spain, 2200 feet in height; and the *plateaux* of Central Asia, rising successively from 3000 to 6000, 12,000, and 16,000 feet above the sea-level. Such elevated plains are accompanied by important physical and vital results, conferring on areas under the tropics the climate, flora, and fauna of temperate regions, and bequeathing to temperate areas all the phenomena of arctic regions.

Table-Layers.—That peculiar structure in certain granites, greenstones, porphyries, and other igneous rocks, which gives to their sections the appearance of stratification, and which is termed by some geologists *pseudo-strata*, and by others the *stratiform structure*. In many instances this division into parallel planes seems to be the result of *jointing*, or some analogous structure, on a large scale; in others, it is merely the mark of the *successive overflows* of igneous matter which constitutes the mass.

Tabrées Marble.—A beautiful transparent limestone, composed of innumerable laminae, thin as paper, and formed by deposition from a celebrated calcareous spring near Maragha.

Tabular.—Composed of, or arranged in, square blocks or *table-like masses*, as many granites and greenstones. The “tabular” frequently passes into the “columnar” structure, and *vice versa*.

TAB — TAL

Tábular Spar.—The *prismatic augite spar* of Mohs, the *Schaalstein* of Werner, and *Wollastonite* of other mineralogists.—See **WOLLASTONITE**.

Táchylite (Gr. *tachys*, quick, and *lithos*).—A black vitreous mineral of the hornblende family, occurring in amorphous fragments in the softer trap-rocks, and nearly related to obsidian and isopyre. The name has reference to the ease with which it fuses under the blowpipe; same as the *hyalomelan* or black-glass of Hausmann.

Tacónic.—A term applied by the late Professor Emmons to the rocks east of the Hudson (from the Taconic range lying along the western slope of the Green Mountains), and which consist of slates, quartz-rock, and limestones of Lower Silurian or perhaps more properly of Upper Cambrian age.

Taniópteris (Gr. *tainia*, a ribbon, and *pteris*, fern).—A genus of elegant ferns occurring in the Lias and Oolite, and so named from their long, narrow, tapering, riband-like leaves, which are furnished with a strong midrib, and have secondary bifurcating veins almost at right angles to the midrib. On some specimens the *scori* or seed-specks are still visible, thus bringing them in pretty close affinity with the simple-leaved *aspidiums* and *polypodies* of our own day.

Talc (Ger. *Talk*).—A common magnesian mineral occurring in masses, composed of thin crumpled laminæ or foliæ, or in scaly aggregates like mica, which it also often resembles in colour. It is easily distinguished, however, from mica in being much softer, and, though flexible, not elastic. Like other magnesian minerals, it feels greasy; and, though varying in colour, its prevalent hue is a greenish or yellowish white, lustre pearly, transparent in very thin plates, and infusible. Its chemical composition is, 63.9 silica and 36.1 magnesia; but a part of the latter is often replaced by iron protoxide. Talc occurs not only as a simple mineral, but enters with quartz, mica, chlorite, and felspar into the composition of many of the crystalline rocks, as talc-schist, chlorite-schist, steatite, serpentine, &c. Common talc is used for crayons, for polishing stones, for crucibles, as a filling material or absorbent of grease, and also in porcelain mixtures.—See the following compounds, and **STEATITE**.

Tálcite.—An occasional synonyme of *Phollerite* or *Nacrite*, a hydrated silicate of alumina, occurring chiefly in granitic veins.—See **NACRITE**.

Tálcose.—Applied to rocks which have a talc-like aspect, or which contain talc as a notable ingredient of their composition; *e.g.*, chlorite-schist, talc-schist, steatite, serpentine, potstone, and the like.

Tálcose Granite.—A granitic rock composed of felspar, quartz, and talc or chlorite; known also as **PROTOGENE**, which see.

Talc-Schist.—A glistening schistose rock of the metamorphic series, consisting of talc and quartz, arranged in foliæ more or less crumpled; of various colours, but greenish hues prevail; has a greasy feel, and generally associated with mica-schist, chlorite-schist, steatite, and serpentine.

Tallow, Mineral.—One of the mineral resins, or hydrocarbons; a light, soft, fatty substance of a greenish-yellow colour, and usually known as **HATCHETINE**, which see.

Talpa.—The mole; remains of species of this well-known insectivorous mammal have been found from the Miocene Tertiaries upwards.

Tálus (Lat.).—In fortification, the outside of a wall or rampart which slopes inward and upward, the wall diminishing in thickness as it rises in height. Adopted in geology to designate the sloping mounds of detritus which accumulate at the bases of cliffs and precipices, being derived from

TAM — TAR

their weathered and wasted surfaces. In many instances, where the cliffs are high and the rocks of a wasting nature, the talus in the course of ages assumes gigantic dimensions, and its long sloping surface becomes a characteristic feature of the landscape.

Tamping.—A term employed in rock-blasting to signify the clay, sand, or other rubbish rammed or stamped down on the powder in the bore-hole for the purpose of preventing the charge from being blown from the hole as from a gun-barrel, and thus compelling it to *burst* the rock in which it has been lodged.

Tannin.—Impure or crude tannic acid, occurring in the bark of oak and other trees. It is a powerful antiseptic, hence this property in *peat-mosses*, &c., derived mainly from the accumulated decay of vegetable substances.

Tantalite.—Known also as *columbite*; the ore of the metal tantalum or columbium, occurring in prismatic crystals, or in granular masses, in the granites of Finland. When recently broken, tantalite is of a dark bluish-grey or iron-black colour; has a specific gravity from 7 to 8; and consists of about 84.5 tantalic acid, 14.5 iron protoxide, and 1 protoxide of manganese, with a trace of oxide of tin. Those varieties which contain upwards of 5 per cent tin oxide are termed *Casitero-tantalites*.

Tantalum.—The metal extracted from *tantalite* and *ytro-tantalite*. It is of a dark-grey colour, very dense, and difficult of fusion. Said to derive its name from the insolubility of its oxide in acids, in allusion to the fable of Tantalus, who, though up to the chin in water, could not drink.

Tapiridae.—The tapir family; a group of pachydermatous animals, having thick massive bodies, short semi-prehensile trunks, three pair cutting and one pair canine teeth, very short tails, four-toed fore-feet and three-toed hind-feet; having much the aspect of a pig, but about the size of an ass; and represented by the tapir of South America. They are sometimes marked as a sub-family of the *Elephantidae*, under the term *Tapirina*, which includes only two or three living species, but embraces numerous fossil congeners from the Tertiaries of Europe, as *Palæotherium*, *Lophiodon*, *Coryphodon*, &c.

Tapirothérium.—Literally “tapir-beast;” a gigantic quadruped of the Eocene period, having intimate structural relationship to the existing tapirs, whence the name.

Tap-Root.—In botany, the main root of a plant, which passes directly downwards, as a continuation of the aerial stem or trunk.

Tar, Mineral.—A variety of bitumen or inspissated petroleum, found oozing from the rocks of different formations, but often from limestones in connection with lignite or coal, and occasionally in volcanic districts.—See BITUMEN.

Taragmite Series (Gr. *taragma*, disturbance).—A term employed by Dr Fleming in his ‘Lithology of Edinburgh,’ to embrace the Boulder Clay, or lowest stage of the modern epoch, as “having been formed when violent aqueous movements were taking place, and probably at a period when the state of our island was widely different from the present.” The Brick-clays which lie above he terms the *Akumite* or tranquil series; and the more superficial deposits, the *Phanerite* or evident series.—See MODERN EPOCH.

Tarai.—“This name,” says Dr Hooker in his ‘Himalayan Journal,’ “is loosely applied to a tract of country at the very foot of the Himalayas: is Persian, and signifies *damp*. Politically the Tarai generally belongs to the

hilly states beyond it; geographically it should belong to the plains of India; and geologically it is a sort of neutral country, being composed neither of the alluvium of the plains nor of the rocks of the hills, but for the most part of alternating beds of sand, gravel, and boulders brought down from the mountains. The Tarai soil is generally light, dry, and gravelly, and varies in breadth from 10 miles along the Sikkim frontier, to 30 and more at the Nepaulese. The gravel-beds extend uninterruptedly upon the plains for fully 20 miles south of the Sikkim mountains, the gravel becoming smaller as the distance increases, and large blocks of stone not being found beyond a few miles from the rocks of the Himalaya itself, even in the beds of rivers, however large and rapid. Throughout its breadth this formation is conspicuously out into flat-topped terraces, flanking the spurs of the mountains, at elevations varying from 250 feet to nearly 1000 feet above the sea. These terraces are of various breadth and length, the smallest lying uppermost, and the broadest flanking the rivers below. The isolated hills beyond are also flat-topped and terraced. This deposit, which is of recent formation, contains no fossils; and its general appearance and mineral constituents are the only evidence of its origin, which is no doubt due to a retiring ocean that washed the base of the Sikkim Himalaya, receiving the contents of its rivers, and wearing away its bluff spurs."

Tardigrada (Lat. *tardus*, slow, and *gradus*, a step).—Literally "slow walkers;" a term variously employed by zoologists, but first used by Cuvier to designate the *Sloths* of South America, in allusion to their slow and difficult mode of progression while on the ground.—See BRADYPIDÆ.

Tarnowitzite.—A variety of *Arragonite* from Tarnowitz in Upper Silesia, containing from 3 to 4 per cent of carbonate of lead.

Tastes of Minerals.—As a means of distinguishing many of the soluble minerals, the taste has been employed; hence mineralogists speak of the *astringent*, like vitriol; *sweetish astringent*, like alum; *saline*, like common salt; *alkaline*, like soda; *cooling*, like saltpetre; *bitter*, like Epsom salts; *sour*, like sulphuric acid, and so on.

Taxites (Lat. *taxus*, the yew-tree).—The generic term for such coniferous remains as are evidently allied to the yew-tree. They occur in the Oolite, but chiefly in the Tertiary lignites.

Taxodites.—Fossil plants found in Tertiary deposits, and allied to the *Taxodium*, or deciduous cypress of North America; a tree which often attains most gigantic dimensions in the southern swamps of that country.

Taxoxylon (Lat. *taxus*, and *xylon*, wood).—A name given by Unger to certain yew-like twigs and branches from the upper Tertiaries of Europe.

Tchernozem or **Tchernon Sem** (Tart.).—Literally, "black mould;" a local name for the black earth of the south of Russia, which covers the whole of the Aralo-Caspian plain—a range of country embracing not less than 100,000,000 acres. It varies from 4 to 20 feet in thickness; is remarkable for its fertility; and consists chiefly of silica with a little alumina, lime, and oxide of iron, and about 7 per cent of carbonaceous or vegetable matter, of which no less than 2.45 is nitrogen gas! This remarkable deposit covers every other in the district, and is evidently of alluvial origin.

Tebbad (Pers.).—Literally, "fever-wind;" the name given to the hot, scorching winds that sweep across the dry sandy plains of Central Asia, carrying clouds of impalpable sand along with them, which are said to fall like "flakes of fire" on the skins of the unfortunate travellers.

Teeth (Teut. *zahn*; allied to the Latin *dens*, and Greek *odous*).—From their hardness and durability the teeth of animals are generally well preserved in stratified deposits, and are not unfrequently the only fossilised remnants of the creatures to which they belonged; hence their importance to the palaeontologist. They consist of three tissues—*dentine*, which forms the body of the tooth; *cement*, which constitutes the harder outer coating; and *enamel*, which lies between the dentine and cement, and is the hardest of all known animal tissues. The teeth of different classes differ in composition, size, form, structure, and so forth, according to the habits and requirements of the animal;—some being fitted for cutting and tearing flesh, others for gnawing and crunching bones; some for grinding and pounding the harder vegetable substances, others for crushing softer tissues; some for seizing and retaining such slippery prey as fishes, while others are fitted for rasping and nibbling the bark of trees, transfixing insects, crushing shell-fish, or it may be serving as organs of offence and defence, or assisting in progression, climbing, anchoring, and the like. Whatever their function, it is usual to divide them into *incisors* or front cutting teeth, *canines* or side seizing and tearing teeth, *premolars* and *molars*, or true grinding teeth;—and according to the requirements of the animal, one or other, or even all, of these divisions may be suppressed, or one set enormously developed into “tusks,” at the expense of the rest. This idea of answerable teeth in the different classes of animals has given rise to what is termed “dental formulæ” for each class; *i* standing for incisor, *c* for canine, *p* for premolar, and *m* for molar. Thus in man, the number of these teeth on each side of the jaws is represented by the following brief formula:— $i \frac{2.2}{2.2}; c \frac{1.1}{1.1}; p \frac{2.2}{2.2}; m \frac{3.3}{3.3} = 32$. Hence, knowing the functional characteristics—the size, form, structure, &c.—of each class of animals, the palaeontologist can often, by microscopic sections and rigid comparisons, arrive at sound conclusions as to the affinity of extinct animals, whose sole remains consist of a few teeth, or, it may be, even the fragment of a single tooth. Thus fish teeth are readily separable from reptilian teeth, and reptilian from mammalian; while each great family of fishes, reptiles, and mammals have their permanent dental characteristics which the skilful odontologist can easily detect. For the specialities of the subject see Owen’s ‘Odontography,’ and his article ‘Odontology’ in ‘Encyclopædia Britannica.’

Teleology (Gr. *teleos*, complete, brought to an end, and *logos*).—The doctrine of final causes. **Teleologist**.—One who seeks for the final causes of phenomena.

Teleosaurus (Gr. *teleos*, complete, and *sauros*, lizard).—A genus of Crocodilian reptiles belonging to the Oolitic period, and characterised by their having (like the recent Gavial) long slender muzzles, with numerous pointed teeth, but differing in having the nasal apertures terminating in two orifices in front of the nose, and not blended into one opening as in the recent species. The osseous scutes of the dermal covering, the skull and jaws with teeth, the vertebral column, and many other bones, have been found, indicating four or five species at least, the individuals of which varied from three to fifteen or eighteen feet in length.—See STENEOSAURUS.

Telérpeton (Gr. *tele*, afar off, remote, and *herpeton*, reptile).—A small lizard-like reptile from the white sandstones of Lossiemouth in Morayshire, and so named in allusion (palaeontologically speaking) to its remote anti-

quity. Its osteology seems to denote a blending of Lacertian characters with those of the Batrachians. The Triassic affinities of *telesternon*, *stagonolepis*, and other reptilian remains from the sandstones of Lossiemouth, have recently suggested the possibility of these strata being Triassic or Liassic, and not Old Red Sandstone, as has hitherto been supposed. The lithological evidence is still, however, incomplete, though tending generally towards the idea of their Triassic origin.

Tellurium (Lat. *Tellus*, the goddess of the earth).—A rare metal of a brilliant tin-white colour; very easily fusible, and usually found massive and disseminated along with quartz, gold, and iron-pyrites, in some of the mines of Germany and Hungary. It was discovered and named by Klaproth in 1782, but has not been applied to any useful purpose. The native metal is rarely found pure, but contains a minute percentage of gold or of iron, and the ores enumerated by mineralogists are complex and uncertain admixtures, as *graphic tellurium*, consisting of tellurium, gold, silver, and lead; *white tellurium*, of tellurium, gold, silver, lead, and sulphur; and *black tellurium*, of copper in addition to the preceding constituents.

Temperature of the Earth.—As one of the orbs of the solar system, the Earth has a variable and irregular *surface temperature*; it has also a *temperature peculiar to the rocky crust*; and judging from volcanic action, hot springs, and the like, there is also a higher and more remarkable *interior or central temperature*. Without entering upon any questions as to the exact proportions that exist between the solid rocky crust accessible to our investigations, and the inaccessible interior, of which we can know nothing by direct observation, we know enough of the Earth's Temperature to warrant the following general conclusions:—1. That the surface temperature is mainly derived from the sun, and that, though variable and irregular during any one season, it is, on an average of many seasons, capable of being laid down with considerable certainty; 2. That the temperature of the crust, as depending on external heat, is also variable to the depth of from 60 to 90 feet, but that at this limit it remains stationary; 3. That downwards from this invariable stratum the temperature increases (as has been proved by experiments in mines and Artesian wells) at the ratio of one degree for every 60 feet, and that at this rate a temperature would soon be reached sufficient to keep in fusion the most refractory rock-substances; 4. That this high internal temperature is apparently the cause of hot springs, volcanoes, earthquakes, and other igneous phenomena, which make themselves known at the surface; and, lastly, That intense as the interior heat may be, the surface of the globe is scarcely, if at all, affected by it (according to Fourier, only $\frac{1}{14}$ th of a degree), owing to the weak conducting properties of the rocky crust.

Temperature of the Ocean.—Respecting the temperature of the ocean, though as yet few observations have been made, we know it is more equable than that of the land; that at the depth of 60 fathoms or so it is pretty constant; that it is colder in summer than the surrounding atmosphere of any contiguous district, while in winter it is always several degrees higher—thus exercising the function of a great storehouse of heat for modifying and equalising the climates of the adjacent lands. Its *mean temperature*, from such experiments as have been made, is estimated at $39\frac{1}{2}^{\circ}$ or $7\frac{1}{4}^{\circ}$ above the freezing-point of pure water, and as nearly as possible at the point of its mean density. Its *surface temperature* varies of course with the latitude—shading off from about 80° or 82° at the equator

to 40° at the 56th parallel, and thence down to perpetual ice at either pole; that is, laying aside the problematical existence of an open sea surrounding the north pole, as has been affirmed by some of our arctic voyagers.

Tenacity (Lat. *tenax*, tough, capable of holding together).—The degree of force with which particles of bodies cohere or are held together. Applied especially to metals which can be drawn into wire, as gold, silver, copper, iron, &c.

Tennantite (after Mr Tennant, the London mineralogist).—A variety of grey copper ore (sulphuret of copper) occurring in the mines of Cornwall along with common copper-pyrites. It is distinguished perhaps by its large percentage of arsenic—ranging from 10 to 20 per cent of the whole.

Tentacula (Lat. *tentaculum*, from *tento*, I feel by touching frequently, and that from *tendo*, I stretch forth).—Feelers; slender, flexible, and often jointed organs, possessed by many tribes of animals, and used for the purposes of feeling, exploring, prehension, locomotion, or for attachment to other bodies—e.g., the tentacula of polypes, sea-anemones, cuttle-fishes, and the like.

Tentaculites (Lat. *tentacula*, feelers).—A genus of annulated feeler-like organisms occurring in Silurian strata; of annelid origin, and probably allied to *Serpula*. "They were annulated, shelly tubes, of a highly complex structure," says Mr Salter, "and not jointed tentacles or stems."—See CORNULITES.

Téphroite (Gr. *tephros*, ash-coloured).—Anhydrous silicate of manganese, occurring in distinct crystalline and granular masses, of an ash-grey colour (whence the name), and consisting of 30 silica and 70 protoxide of manganese, with traces of iron and lime.

Teratosaurus (Gr. *teras*, *teratos*, a prodigy, and *sauros*, lizard).—Literally "wonderful lizard;" a singular reptile from the Upper Keuper Sandstone of Stuttgart, figured and described by Von Meyer in his 'Paleontographica.' The only remains of the genus at present known are a portion of the head (consisting of the maxillary, nasal, and orbital bones), two detached teeth, and probably a coracoid. The teeth resemble those of *Megalosaurus*, but, according to Von Meyer, the remains indicate, on the whole, a true Lacertain type, having some affinities to the existing genera *Stellion* and *Uromastix*.

Terebratella.—A genus of brachiopods resembling terebratula; having the shell smooth, or radiately plaited; dorsal valve longitudinally impressed; hinge-line straight or not much curved; beak with a flattened area on each side of the deltidium; foramen large; deltidium incomplete; loop attached to the septum. About twenty species are found fossil from the Lias upwards, and about the same number still exist in the seas of the higher latitudes in both hemispheres at from 90 to 95 fathoms' depth.

Terebratula (diminutive of *terebratus*, perforated, in allusion to the perforation of the beak).—A genus of brachiopod bivalves, of which about 100 species have been enumerated from the Silurian system upwards, and a few species of which are still existing as deep-sea molluscs (from 90 to 250 fathoms). The genus has been taken as the type of the family *Terebratulidae*, which is characterised by the shell being minutely punctate; usually round or oval, smooth or striated; ventral valve with a prominent beak and two curved hinge-teeth; dorsal valve with a depressed umbo; a prominent cardinal process between the dental sockets, and a slender shelly loop. The family embraces such genera as *Terebratula*, *Terebratella*,

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Argiope, *Thecidium*, and *Stringocephalus*, together with many doubtful sub-generic or merely specific forms.

Teredina.—An extinct genus of boring molluscs, whose perforations are common in the drift-wood of the London Clay. "The calcareous tube of the *teredina* was united, and, as it were, soldered on to the valves of the shell, which cannot therefore be detached from the tube, like the valves of the recent *Teredo*," which see.

Teredo (Gr. *teredon*, from *tereo*, I bore).—A genus of marine bivalves belonging to the *Pholas* family, and so called from their habit of boring into and taking up their lodgment in wood. The animal is elongate and worm-like; hence the familiar designation of "ship-worm;" and the shell is somewhat globular, open in front and behind, and lodged at the inner extremity of a tubular, straight, or flexuose burrow, partly or entirely lined with shell. About twenty living species of *teredines* are known; and about the same number have been found fossil from the Lias upwards. Fragments of drift-wood drilled by the *Teredina* (an extinct genus) are common in the London Clay.

Terra Cotta (Ital.).—Literally "baked earth;" a term applied to a kiln-burnt ware prepared from the purest kinds of fire-clay, and usually employed for vases, mouldings, and other architectural ornaments. "The best *terra cottas*," says Ansted, "are made in France, and the manufacture has there attained a high state of perfection. Various attempts in England have met with partial success; the unequal contraction of the material being a difficulty rarely surmounted."

Terra Ponderosa (Lat.).—Literally "heavy earth," another name for heavy-spar or *Barytes*, which see.

Terra Sienna.—A yellow-coloured ochraceous earth or bole, used as a pigment; and so called from its being brought from Sienna, in Italy. In its natural state it is known as *Raw Sienna*; and when roasted and rendered redder in colour it is called *Burnt Sienna*.

Terrace.—Any shelf or bank of land having a uniformly flat or level surface. Such terraces are produced by the operations of water, and are either ancient sea-margins (*raised beaches*), formed by gradual upheaval of the land; or *lake* and *river terraces* that point to a time when the valleys in which they occur were either occupied by lakes at these heights, or had their whole surfaces at these levels, and before their rivers had worn their channels down to lower depths. In this way we may have *terraces of deposition* as well as *terraces of denudation*.

Terrátolite.—Glocker's term for *Hard lithomarge*—the *terra miraculosa Saxoniae* of old authors.—See LITHOMARGE.

Terricola (Lat. *terra*, the earth, and *colo*, I inhabit).—An order of Annelids which, like the earth-worms, burrow in the earth; hence the name. How far some of the "annelid tracks" and "annelid burrows" of the stratified systems may have resulted from the operations of terrestrial worms, palæontology has not yet determined.

Tertiary (Lat. *tertius*, third).—Of or belonging to the Tertiary system—the third or upper great division of the stratified systems, as distinguished from Secondary and Primary; hence we speak of "Tertiary epoch," "Tertiary fossils," "Tertiary strata," &c.—See TERTIARY SYSTEM.

Tertiary System.—The earlier geologists, in dividing the stratified crust into primary, secondary, and tertiary formations, regarded as *Tertiary* all that occurs above the Chalk. The term is still retained, but the progress

of discovery has rendered it necessary to restrict and modify its meaning. Even yet the limits of the system may be said to be undetermined—some embracing under the term all that lies between the Chalk and Boulder-drift, others including the Drift and every other accumulation in which no trace of man or his works can be detected. Palæontologically speaking, much might be said in favour of both views; but the difficulty of unravelling the relations of many clays, sands, and gravels, makes it safer to adopt, in the mean time, a somewhat provisional arrangement, and to regard as TERTIARY all that occurs above the Chalk till the close of the Drift, and as POST-TERTIARY every accumulation which appears to have been formed since that period. Adopting this view, we have the following intelligible synopsis:—

POST-TERTIARY.	{ RECENT and SUPERFICIAL ACCUMULATIONS occurring above the Boulder-drift.
	{ PLEISTOCENE...Boulder or Glacial Drift.
	{ PLIOCENE.....Mammaliferous, Red and Coralline Crag of Suffolk, &c.
TERTIARY.	{ MIOCENE.....Faluns of Touraine, Molasse of Switzerland, and part of Vienna Basin.
	{ EOCENE.....Strata of London and Paris Basins.

As in other systems, so in the Tertiary, the fossils of the older strata differ considerably from those of the newer; and thus the whole might be conveniently grouped into Lower, Middle, and Upper. Palæontologists, however, have chosen a somewhat different nomenclature, and, taking the percentage of fossil shells as their guide, have adopted the scientific divisions above tabulated. Thus *Ecene* (*eos*, the dawn, and *kainos*, recent) implies that the strata of this group contain only a small proportion of existing species, which may be regarded as indicating the dawn of existing things; *Miocene* (*meion*, less) implies that the proportion of recent shells is less than that of extinct; *Pliocene* (*pleion*, more), that the proportion of recent shells is more or greater than that of the extinct; and *Pleistocene* (*pleiston*, most), that the shells of this group are mostly those of species inhabiting the present seas. This nomenclature is now in general use by English geologists, though it must be confessed that the progress of fossil discovery has long since rendered the divisions lower, middle, and upper, more appropriate, and much less liable to mislead. For further details and foreign equivalents, see tabulations, "GEOLOGICAL SCHEME."

Tessellated (Lat. *tessela*, dim. of *tessera*, a cube or small square of wood used in chequer-work).—Divided into squares or chequers, either by different colours, or by the crossing of striae; chequered; arranged in square or lozenge-shaped compartments.

Testacea (Lat. *testa*, a shell).—A general designation for those molluscous animals that are furnished with a shelly covering, as the oyster, periwinkle, &c., in contradistinction to those which are naked or merely covered with a tough coriaceous tunic (*tunicata*).

Tetra (Gr., four).—A frequent prefix in scientific nomenclature, as *tetragonal*, four-cornered; *tetradactylous*, having four toes, &c.

Tetracatlodon (Gr. *tetra*, four; *caulos*, stalk; and *odous*, tooth).—Literally "four tusk-teeth;" a name proposed by Dr Godman as a generic distinction for some elephantine jaws of the Tertiary period, which have two short tusks in the lower jaws in addition to the long tusks of the

upper jaws. Professor Owen and others regard the *tetracaulodon* of Dr Godman as the immature state of the *MASTODON GIGANTEUS*—the lower tusks being merely milk-teeth, which were lost as the animal became adult. Some palæontologists, however, still retain the distinction, and enumerate several species of the genus *Tetracaulodon*.

Tetrádyomite (Gr. *tetrádyμος*, fourfold).—Sulphotelluride of bismuth; so called from the quadruple macles in which its crystals usually appear. It also occurs massive and granular foliated; of a brilliant steel-grey colour; and consists of 60.00 bismuth, 34.60 tellurium, and 4.80 sulphur.

Tetragonolépis (Gr. *tetra*, four; *gone*, corner; and *lepis*, scale).—Literally "four-cornered scale;" a Liassic fish somewhat similar to the *DAPEDIUS* (which see), but differing in the characters of its scales and teeth, and belonging to the *Pycnodont* family.

Tetralophodon (Gr. *tetra*, four, and *lophos*, ridge).—Literally "four-ridged;" one of Dr Falconer's sub-genera of Mastodons, which he divides into *trilophodon* and *tetralophodon*, according as the crowns of their molar teeth exhibit three or four pap-like transverse ridges with intervening depressions.

Tetrapodichnites (Gr. *tetra*, four; *pous*, *podos*, foot; and *ichnon*, a footprint).—The footprints of four-footed creatures, as batrachian reptiles, and other terrestrial saurians.—See *ICHNITES*.

Tetrápterus (Gr. *tetra*, four, and *pteron*, wing or fin).—Four-finned; a genus of fossil fishes peculiar to the Chalk formation, and characterised, according to Agassiz, by the close apposition of their pectoral and ventral fins.

Thalactroides.—Fossil fruits belonging to plants of the order *Ranunculaceæ*, and related to *Thalictrum* (Meadow-Rue); hence the name. They have been found in the Eocene strata of France and England.

Thalassiophytes (Gr. *thalassios*, belonging to the sea, and *phyton*, a plant).—Literally "sea-plants;" a term occasionally employed to embrace the entire vegetable productions of the ocean—its deep waters, its rocks, and its shores.

Thecodont (Gr. *theke*, a sheath, and *odous*, *odontos*, tooth).—In expressing the leading modifications in the mode of attachment of the teeth among the inferior or squamate saurians, Professor Owen makes use of the following terms: viz., *acrodont* (*akros*, the summit), those which have the teeth anchylosed to the summit of the alveolar ridge; *pleurodont* (*pleuron*, the side), those which have them anchylosed to the bottom of an alveolar groove, and supported by its side; and *thecodont*, those which have the teeth implanted in sockets, either loosely or confluent with the bony walls of the cavity.

Thecodontia (Gr. *theke*, a case or sheath, and *odous*, *odontos*, tooth).—One of the thirteen orders into which Professor Owen proposes to arrange the Reptilia, living and extinct. The name has reference to the implantation of the teeth in distinct sockets; and the genera of the order seem peculiar to Permian and Triassic strata. In the Thecodonts the vertebræ are biconcave; the ribs long and bent, the anterior ones with a bifurcate head; the sacrum consists of three vertebræ; and the limbs ambulatory, the femur having a third trochanter. The teeth have the crowns compressed, pointed, with trenchant and finely serrated margins; and implanted in distinct sockets.

Thecodontosaurus (Gr. *theke*, a sheath or socket, and *odous*, *odontos*,

tooth).—Literally “socket-tooth saurian;” a type of reptile apparently peculiar to the Permian epoch; and so called from having the teeth implanted in distinct sockets, as in the crocodile. The remains were first discovered by Dr Riley and Mr Stutchbury in the dolomitic conglomerate of Somersetshire, and consist of jaws, teeth, vertebrae, and bones of the extremities; but similar forms have since been obtained from the Permians of Russia, Germany, and Chatham in North Carolina. “The teeth,” says Dr Mantell, “are pointed, compressed laterally, trenchant, and finely serrated on the edges. These reptiles, in their thecodont type of dentition, biconcave vertebrae, double-headed ribs, and proportionate size of the bones of the extremities, are nearly related to the Teleosaurus of the Oolite; but combine a lacertian form of tooth and structure of the pectoral arch with these crocodilian characters; and the bodies of the vertebrae have a series of ventricose excavations for the spinal chord, instead of a cylindrical canal.”

Thélodus (Gr. *thela*, a little nipple, and *odus*, tooth).—A fish of the Silurian bone-bed; so called from its peculiar mammillated teeth. Nothing is yet known of its true affinities.

Thénardite (after M. Thenard).—Anhydrous sulphate of soda occurring in crystalline crusts, of a vitreous white colour, at the salt-springs of Espartinas, near Madrid, where it is deposited from the waters during the summer months. It occurs also in Peru, and is used for preparing soda.

Thermal (Gr. *therme*, heat).—Warm; applied to hot springs and other waters whose temperature exceeds 60° Fahrenheit. The term **HYDROTHERMAL** is frequently used to express the action of heated waters and steam in contradistinction to that of volcanoes or of dry combustion.

Thermonatrite (Gr. *therme*, heat, and *natron*, crude carbonate of soda).—Haidinger's term for prismatic carbonate of soda, consisting of 50.1 soda, 35.4 carbonic acid, and 14.5 water, with slight earthy impurities. It occurs with natron in the lakes of South America, the Egyptian desert, &c., and is deposited from their waters during the warm season; whence the name. According to Haidinger, a saturated solution of soda at a temperature of 77° to 99° Fahr., and cooling slowly, forms crystals of *thermonatrite*; whereas a less saturated solution at a lower temperature forms crystals of *natron*.

Thin-out.—A stratum is said to “thin-out” when it becomes thinner and thinner, as you trace it in any direction, till it finally disappears, and its place is taken by some other stratum. A *thin-out* is, in fact, the natural termination of every stratum, unless its edge has been brought to the surface by subterranean disturbance, and then it is said to *crop-out*.

Thómsomite (after Dr Thomson, the well-known chemist).—A mineral of the zeolite family, occurring in rectangular prisms in druses, in fan-shaped or in radiated aggregates of a whitish colour; and found with calc-spar and other zeolitic minerals in cavities in amygdaloid, basalt, greenstone, and old lavas. Known also as *Comptonite*, and consists of silica 38.5, alumina 30.6, lime 12.6, soda 4.8, and water 13.15.

Thorina.—The protoxide of the metal *thorium*, an earth discovered by Berzelius in the mineral thorite; *thorium* being named after the Scandinavian deity *Thor*.

Thórite.—A hard, brittle, reddish-brown, massive mineral occurring in the Syenites of Norway, and yielding to analysis about 58 per cent of the earth *thorina*.

Thriasonótus (Gr. *thrix*, *thrisos*, bristle, and *notos*, back).—Literally "bristle-back;" a genus of fishes peculiar to the Lias and Lower Oolite, and characterised by the peculiarity of their dorsal fin.

Thriassops (Gr. *thrix*, bristle, and *opsis*, appearance).—One of Agassiz's genera of fossil fishes, occurring in the Lias and Oolite, and so named from the long bristle-like character of their fin-rays.

Throw.—A miner's term for *fault*, because of its displacing the strata—"throwing" them up on one side and down on the other. The "throw" is the amount of vertical displacement occasioned by a fault; hence the fault is said to be an *upthrow* or *downtthrow*, an *upcast* or *downcast*, according to the side from which it is viewed.

Thrust.—Applied in mining to the breaking-down of the roof of a gallery or any similar opening, by the pressure or thrust of the superincumbent rocks.—See CRUSH and CREEP.

Thúites.—A genus of coniferous plants occurring in fragments in the shale and coal of the Oolite, and so called from the resemblance of their imbricated stems and terminal twigs to those of the modern *Thuja* or *Thuya*, better known as the *Arbor-vita*.

Thúlite.—A rare variety of epidote of a rose or peach-blossom colour, occurring in granular masses in the granites of Svuland in Norway.

Thúmmarstone or **Thummerstein**.—The *Axinite* of other mineralogists; so called by Werner from its occurring in the crystalline rocks of Thum in Saxony.

Thunderbolts.—A familiar term of the English peasantry for *Belemnites*, the majority of which are straight, round, and tapering, or of a bolt-like form.

Thylacólé (Gr. *thylakos*, pouch, and *leo*, lion).—Literally "pouched lion;" a carnivorous marsupial mammal from the Pleistocene or uppermost Tertiaries of Australia; and so called from the trenchant dentition of its skull (the only portion yet found), which rivals that of the lion in size.

Thylacothérium (Gr. *thylakos*, a pouch, and *therion*, animal).—A small marsupial mammal of the Oolite. Apparently the same as *Amphitherium*, which see.

Tides.—The name given to those regular oscillations, or risings and fallings of the water of the ocean, which are occasioned by the attraction of the moon and sun, and which occur twice in the course of the lunar day (24 hours, 50 minutes). The flow, or rising towards the shore, is called *flood tide*, and the falling away *ebb tide*. The highest point to which the flood tide attains is called *high-water*, and the lowest to which the ebb tide sinks is *low-water*. During high and low water there is a short period of rest, or no current either way, and this is called *slack-water*. When the sun and moon act in the same direction (that is, at full moon), the greatest tidal rise will take place, and these are known as *spring-tides*; but when these luminaries are in opposition (that is, during the third and first quarters of the moon), the rise is least, and then we have *neap-tides*. As geological agents, the tides are of vast importance in scouring away, transporting, and reasorting the debris of the ocean.

Tile-Ore.—A variety of red oxide of copper, of a reddish-brown colour, occurring massive or incrusting, earthy or more or less indurated. It consists of sub-oxide of copper, mixed with much peroxide of iron and other substances.

Tilestone.—Any thinly-laminated sandstone suitable for roofing; applied

specially to the flaggy beds at the base of the Old Red Sandstone. The "Tilstones" as a group are regarded as the "passage or transition beds" between the Silurian and Devonian systems; and have been ranked by some geologists with the one system, and by others with the other. As developed in Hereford, Lanark, and Forfar, lithologically and palaeontologically, we are inclined to consider them as the true basis of the Old Red Sandstone.

Tilgate Forest, in Sussex, situated on the clays, sandstones, and calciferous grits of the Wealden formation; a district rendered classical by the discoveries of the late Dr Mantell.—See his 'Fossils of Tilgate Forest,' 1 vol. 4to, 1827.

TILL.—A provincial Scotch term for the stiff unstratified clays of the Boulder formation; and now beginning to be used by geologists for any thick unstratified alluvia.

Tilted Up.—Applied to strata that are suddenly or abruptly thrown up at a high angle of inclination. *Tilts* of this nature are usually accompanied by fractures and crushings of the strata.

Tin (Lat. *stannum*).—A well-known metal of a silver-white colour, slightly tinged with grey, having a peculiar taste, and an odour which may be readily recognised when held for a while in the warm hand. It is considerably harder than lead; has a specific gravity of 7.3; and fuses at 442° Fahr.—a temperature 170° below the melting point of lead. It is very malleable when heated to about 200°, and is readily beaten into leaf or *tin-foil*: but it is not very ductile, though it may be drawn into wire of feeble tenacity. It is flexible, bending with a crackling noise, apparently the result of its crystallised structure—the fused metal crystallising in regular octahedrons. As a metal that does not readily tarnish, it is employed for coating sheet-iron (tin-plate) and copper; and its *foil*, alloyed with quicksilver, forms the reflecting surface of glass mirrors. It also unites with other metals and forms valuable alloys, as *bronze*, *bell-metal*, *speculum-metal*, and the like; and its salts, dissolved in muriatic acid, are used in dyeing and calico-printing. It has not been found native (or at least very doubtfully so), but it is obtained from *cassiterite*, pyramidal tin-ore or oxide of tin, which occurs in veins in the granitic and crystalline rocks of Cornwall, Saxony, Spain, the East India Islands, and other localities.

Tin-Ore, Tin-Stone.—The familiar name given to the oxide of tin, or *Cassiterite*, as being the only ore from which the tin of commerce is derived. It occurs in veins in the granitic and crystalline rocks, and is usually associated with wolfram, copper, iron-pyrites, and other minerals. It is found either in blackish-brown pyramidal or prismatic crystals; or massive in granular aggregates; and not unfrequently in rounded fragments in gravelly detritus. The name *wood-tin* is given in Cornwall to the kidney-shaped masses which have a finely fibrous or radiated structure; *toad's-eye-tin*, to the same variety when the concretions are small and berry-like; and *stream-tin*, to the gravel-like ore found with detritus in the gullies and water-courses of metalliferous districts. As an ore, it consists of 77.50 tin, 21.50 oxygen, with traces of iron and silica; and being disseminated through the veinstone, the rock must be pounded and washed before the ore can be smelted. As a geological generalisation, it is asserted that in Cornwall tin usually occurs in the upper portion of the veins, while copper is found below.

Tin-Pyrites.—Known also as *Stannine* or *Bell-metal ore*; a sulphuret of copper, tin, and iron—the iron sometimes replaced by zinc. It is a

mineral of a steel-grey or sometimes of a coppery-yellow colour; occurring massive, granular, and disseminated, rarely crystallised; and is usually associated with tin-ore in the veins of Cornwall and Bohemia.—See STANNINE.

Tinca, Tinkal (the Oriental term for borax).—Crude borax, as it is imported from the East Indies in dirty-yellow crystals. When refined it constitutes the *Borax* of commerce, which see.

Tirolite (occurring in many parts of the Tyrol).—Known also as *Copper-froth*; a fine verdigris-green or azure-blue carbonate of copper and arsenic, occurring in reniform or mammillary aggregates, with a radiating foliated texture and drusy surface. It is found in beds and veins with other copper ores.

Titaniferous.—Containing or yielding titanic acid and titanium; as *titaniferous cerite*, a blackish-brown mineral, consisting of the oxides of cerium, iron, manganese, and titanium; *titan-schorl*, known also as *rutile* or *ingrine*, a mineral consisting of oxide of titanium and peroxide of iron; *titaniferous iron-sand*, or *iserine*, occurring in roundish grains generally in connection with Tertiary volcanic districts, and sometimes in such abundance as to be used for the production of steel, of which it produces a tough and very superior kind.

Titanite.—Prismatic titanium ore; a silico-titanite of lime; better known to English mineralogists as SPHENE, which see.

Titanium (Gr. *titanos*, falling to a calx or lime).—One of the elementary substances, discovered by the Rev. Mr M'Gregor in 1789; it is of a dark copper-red colour, with a strong metallic lustre, which readily tarnishes on exposure to the air. As titanic acid, it is a constituent of several minerals, as *Menekeite*, *Sphene*, *Brookite*, *Rutile*, and *Anatase*.

Titanotherium.—Literally "gigantic beast;" a large herbivorous mammal occurring in the Lower Miocene beds of the Missouri district, and having some relations to the modern Tapirs, but more perhaps to the extinct Palæotheres of Europe. Judging from the teeth and jaws, it probably attained a size about twice that of the existing horse.

Tiza.—The name by which borate of lime (*Hayesine*) is called in southern Peru, where it occurs on the dry plains or *salinas* in the neighbourhood of Iquique in white reniform masses, in size from a hazel-nut to a potato.

Toadstone.—A term applied by the Derbyshire miners to certain trap-rocks which occur interstratified, or in connection, with the mountain limestones of that country. Some of these toadstone beds are compact and basaltic, others are earthy, vesicular, and amygdaloidal. By some (and with every degree of probability) the term is said to be from the German *todt-stein* or dead-stone—the rock being dead or unfruitful of lead-ore as compared with the associated limestones; according to others, the rock obtains its name from the resemblance of its amygdaloidal spots to those on a toad's skin.

Topas (Gr. *topasion*, though it is doubtful whether the topasion of the ancients were the same as our topas).—One of the gems; occurring in finely striated prismatic crystals, massive with indistinct crystalline structure, or disseminated in rounded fragments; transparent, vitreous, electric when heated or rubbed, and of various colours or colourless. It is found chiefly in the granitic and crystalline rocks, and frequently associated with rock-crystal, tourmaline, beryl, and euclase, or with fluor-spar and other minerals containing fluorine. It is harder than quartz, has a specific

quantity to show distinctly the forms and colours of objects placed on their other side. A mineral is therefore said to be *translucent* when light evidently passes through its substance, though objects cannot be distinguished through it by the eye.—See **TRANSPARENCY**.

Transmutation (Lat.)—A change from one place to another, or from one thing into another. A term adopted by Lamarck and his followers to express their hypothetical views of the derivation of existing species from preceding species, by slow and gradual *Transmutations* of one form of organisation into another form, independent of the interference of any creative agent, and merely by the influence of external or physical conditions, or by the internal impulses of the organism as affected by extraneous causes.

Transparency (Lat. *trans*, through, and *pareo*, I appear).—Literally “appearing through;” that property of bodies which permits light to pass through them so freely that the forms, hues, and distances of objects can be distinctly seen on the other side. Air, water, the purer kinds of glass, and many minerals, are therefore said to be *transparent*; and this property varies in intensity till it passes into mere *translucency*; and translucency also varies in degree till no light pass through, and the substance is said to be *opaque*.

Trap, Trappean (Swedish *trappa* a stair).—Tabular greenstone and basaltic rocks, from their rising up in step-like masses, were originally so termed; but the name is now extended to all igneous rocks which are not either strictly *Granitic* or decidedly *Volcanic*. Others derive the origin of the term from the terrace-like aspect of Secondary hills, generally composed of interstratified greenstones, basalts, amygdaloids, &c., which stand out in ledges from the softer strata that have yielded to denudation. Whatever the original idea, the term is now employed by geologists to embrace all the multifarious igneous rocks that belong to the Palæozoic and Secondary epochs, as distinct from the more ancient granites on the one hand, and the recent volcanic rocks on the other. The *Trappean* series thus embraces basalt, clinkstone, basaltic clinkstone, greenstone, greenstone-porphry; compact felspar or felstone, felspar-porphry; hornstone, pitchstone, pitchstone-porphry; claystone, claystone porphry; amygdaloid, trap-tuff, wacke, trap-breccia, and the like. As a class, they are mainly composed of felspar, augite, and hornblende, the varieties differing according to the predominance of one or other of these ingredients.

Trass, Tarass.—A provincial German term for a Tertiary tufaceous alluvium or volcanic earth, which occupies wide areas in the Eifel district of the Rhine. Its basis consists almost entirely of pumice, in which are included fragments of basalts and other lavas, pieces of burnt shale, slate, sandstone, and numerous trunks and branches of trees. It seems to have originated either as a volcanic mud, like that thrown out by the craters of the Andes; or as volcanic dust and ashes deposited in the fresh-water lakes of the period. When pulverised it is used as a hydraulic cement, like the pozzolana of Italy.

Travertin.—A whitish concretionary limestone deposited from the water of springs holding lime in solution; abundantly formed by the waters of the Anio, at Tibur, near Rome; hence the name Tiburtinus, Travertinus, or Travertin. It is usually compact, hard, and semi-crystalline, and in this respect is distinguished from *Calc-tuff* or *tufa*, which is a loose and porous surface-deposit.

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Tremadoc Slates.—A series of coloured slates and grits about 1000 feet thick, occurring at Tremadoc in North Wales, and constituting a portion of the Cambrian system of Sedgwick or the Lower Silurian of Sir Roderick Murchison.

Tremblores.—The name given by the Spanish settlers of South America to the *surface-tremors* which, in some volcanic districts, are almost of daily occurrence.

Tremolite (named from Val Tremola).—A variety or sub-species of hornblende, known also as *grammatite* and *calamite*, of a white or greenish-grey colour, occurring in long prismatic crystals or in columnar aggregates—the crystals often bent and striated longitudinally, pearly and semi-transparent. Is found in dolomite, granular limestone, and other subordinate beds in the crystalline rocks.

Tretosternon (Gr. *tretos*, perforated, and *sternon*, the breast-bone).—The generic term applied to the fossil bones of a turtle-like animal from the Wealden and Purbeck beds. It seems to be related to the river-turtles (*Trionyx* and *Emys*) of the hotter regions of Asia, Africa, and America.

Tri- (Gr. *treis*, Lat. *tres*, three).—A frequent prefix of scientific terms signifying thrice, or in threes; as *tripartite*, divided into three parts; *trisectioned*, cut into three segments; *trilobate*, three-lobed; *tripinnate*, three times pinnate, &c.

Trias, Triassic System.—This system derives its name—*Trias* or triple series—from its being composed in Germany, where it is very fully developed, of three main members:—viz., the *Keuper*, the *Muschelkalk*, and the *Bunter sandstein*. These, as far as they can be compared, are lithologically and palæontologically the equivalents of the Upper New Red Sandstone of England, and may be intelligibly co-ordinated as follows:—

	Germany.	England.
1. KEUPER.	Saliferous and gypseous shales, with beds of variegated sandstones and carbonaceous laminated clays.	Saliferous and gypseous marls, with grey and whitish sandstones.
2. MUSCHELKALK.	Compact greyish limestone, with beds of dolomite, gypsum, and rock-salt.	(Wanting.)
3. BUNTER SANDSTEIN.	Various coloured sandstones, dolomites, and red clays; occasional pisolites.	Reddish sandstones and quartzose conglomerates.

Or extending the co-ordination to France, we have the following relations:—

England.	Germany.	France.
Variegated Marls.	Keuper.	Marnes irisées.
...	Muschelkalk.	Calcaire coquillier.
Variegated Sandstone.	Bunter Sandstein.	Grès bigarré.
...	...	Grès des Vosges.

The TRIAS is thus in all its relations the Upper New Red Sandstone of the earlier English geologists, and has been separated from the Lower New Red or PERMIAN, because its flora and fauna are essentially *Mesozoic*, and akin to those of the Oolite and Chalk, while those of the Permian are essentially *Palæozoic* in their facies, and related to those of the Carboniferous

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below. — In England the system is sparingly fossiliferous, but in Germany and France, as well as in Southern Africa and North America, where there is a large development of Red Sandstones, supposed to be of Triassic age, there is a fuller (though by no means exuberant) exhibition of Life, vegetable as well as animal. The flora embraces equisetums, calamites, ferns, cycadaceous and coniferous plants; the fauna, corals, star-fishes, shell-fish, crustaceans, reptiles, numerous footprints of reptiles and birds, and indications of marsupial mammals. — Economically, the system is the great repository of rock-salt and brine-springs in England and Ireland. — See **NEW RED SANDSTONE**, and tabulations, "**GEOLOGICAL SCHEME**."

Tributary. — Applied to any stream which, directly or indirectly, contributes water to another stream. One stream falling directly into another stream becomes an *affluent* to that stream; but both may be *tributaries* to some larger current. An affluent is thus necessarily a tributary, but a tributary is not necessarily an affluent.

Tricarpellites (Gr. *treis*, three, and *karpós*, fruit). — Fossil nut-like fruits from the London Clay, so called from their consisting of three carpels or seed-cells.

Trichœodon. — A provisional genus of marine mammals, founded by Mr E. R. Lankester on some tuks from the Red Clay of Suffolk, which show affinities to the Walrus (*Tricheus*) though apparently of much larger dimensions.

Triconodon (Gr.) — Literally "three-coned tooth;" a provisional genus of small marsupials, founded on some remains of teeth and jaws from the Purbeck or Upper Oolitic beds of England. Nothing is yet known of these Oolitic marsupials (*plagiulax*, *triconodon*, &c.) beyond their teeth and lower jaws.

Trigonellites (Gr. *treis*, three, and *gonê*, corner). — A shell-like organism consisting of two plates or valves, and so called from its triangular form. "The real nature of the shell," says Lyell, "of which there are many species in Oolitic rocks, is still a matter of conjecture. Some are of opinion that the two plates formed the gizzard of a cephalopod; for the living Nautilus has a gizzard with horny folds, and the *Bulla* is well known to possess one formed of calcareous plates."

Trigonia (Gr. *treis*, three, and *gonê*, corner). — A dimyarian bivalve of the Oolite and Chalk, so called from its three-cornered shape. The fossil trigonias are thick, tuberculated, ribbed shells—the ribs either radiating or arranged concentrically: but the shell having been almost entirely nacreous, it is generally wanting, and only the cast remains—the "horse-heads" of the Portland quarrymen. About 100 species are catalogued from the Trias to the Chalk inclusive; none have yet been found in Tertiary strata, but one or two species occur in Australian seas.

Trigoniadae. — A family of conchiferous molluscs, of which *Trigonia* is the type, having equivalve, close, three-cornered shells, with the umbones directed backwards; interior nacreous; ligament external; hinge-teeth few and diverging. The family is chiefly fossil, and includes *trigonia*, *myophoria*, *axinus*, and *lyrodesma*.

Trigonocarpus (Gr. *treis*, three; *gonê*, corner; and *carpos*, fruit). — A genus of thick-shelled fruits occurring in the Coal-measures, and so called from the three projecting ribs or corners which mark the surface of the shell. They vary considerably in size, and are regarded as palm-nuts, to which they bear a striking resemblance.

Trilobite, Trilobitidæ (Gr. *treis*, three, and *lobos*, lobe).—An extensive family of Palæozoic crustaceans, deriving their name from the obvious three-lobed-like aspect of their bodies. The trilobites, in numerous generic forms, as *asaphus*, *ampyx*, *calymene*, *homalonotus*, *ilænus*, *ogygia*, *olenus*, *phacops*, *trinuclens*, &c., are especially characteristic of the Silurian system; about a dozen genera range through the Devonian epoch; only three or four make their appearance in Carboniferous strata; and not a single specimen has been found in any later formation. The skeleton of the trilobite consists of a cephalic shield or plate (*cephalo-thorax*), furnished with prominent many-faceted sessile (very rarely pedunculated) eyes on the upper or dorsal aspect, and beneath a labrum or "hypostome" which would indicate foot-jaws; a three-lobed body in segments less or more numerous; and a caudal plate or appendage (*pygidium*) variously terminated. As yet no indications of antennæ or limbs have been detected; "still," says Owen, "there can be no doubt they enjoyed such locomotive power as even the limpet and chiton exhibit when requisite." Many of them are extremely minute, and in all likelihood the larval forms of larger so-called genera; a considerable number attain a size of from one to six inches; and it is rarely indeed that fragments are found indicating species exceeding twelve or fifteen inches long. For the subdivisions of the group, and its place among the crustacea, see tabulations, "ANIMAL SCHEME."

Trilophodon (Gr. *treis*, three, and *lophos*, ridge).—Literally "three-ridged;" one of Dr Falconer's sub-genera of Mastodons, which are divided by him into *trilophodon* and *tetralophodon*, according as the crowns of their molar teeth exhibit *three* or *four* pap-like transverse ridges with intervening depressions.

Trionyx (Gr. *treis*, three, and *onyx*, claw).—Literally "three-clawed;" a fossil tortoise or chelonian occurring in Tertiary strata; and doubtfully (from three-clawed imprints of footsteps) in any earlier formation.

Triplite (Gr. *treis*, three).—A phosphate of manganese occurring in massive or coarsely granular aggregates, and so called from its being cleavable in three directions, at right angles to each other. Consists of 34 iron protoxide, 33 manganese protoxide, and 33 phosphoric acid.

Tripoli.—A polishing powder originally brought from Tripoli in Africa, but now found in many other places. It is a kind of "rotten-stone," composed of the siliceous shields of microscopic infusoria, and diatomaceæ; an infusorial or microphytal earth of a whitish-grey or yellow colour; soft, light, and friable.

Tristychius (Gr. *treis*, three, and *stychos*, row).—A genus of cestraciont fin-spines or ichthyodolulites from the Carboniferous formation, indicative of shark-like fishes of great size; and so called from the triple row of barbs or tooth-like processes with which they are armed.

Trochitæ (Gr. *trochos*, a wheel).—A name given by the earlier palæontologists to the small detached joints of the encrinite.—See ENTROCHI.

Trochoceras (Gr. *trochos*, a hoop, and *keras*, horn).—A genus of nautilites found in the Upper Silurians of Bohemia. Shell nautiloid, spiral, depressed.

Trochus (Lat. *trochus*, a hoop).—An extensive genus of living and fossil univalves belonging to the family *Turbinidæ*, and characterised by their pyramidal-shaped numerous-whorled shells, which are nearly flat at the base, and have an oblique rhombic aperture which is pearly inside; hence

the common designation of "silver shells." They are found fossil from the Devonian upwards, the fossil being more numerous than the existing species.

Trogontherium (Gr. *trogo*, I gnaw, and *therion*, beast).—Literally "gnawing beast;" an extinct rodent found in the fresh-water Pleistocenes or uppermost Tertiaries of Europe, and so closely allied to the existing beaver that it is by some palaeontologists regarded as a mere specific or sub-generic form. Its bones indicate a size about a fourth larger than the largest known species.

Tróna (Arabic).—A crude carbonate of soda, occurring in crystalline incrustations in the deserts of Africa and Asia, and in the dried-up lakes and river-courses of South America. Consists of about 38 soda, 40 carbonic acid, and 22 water.

Tropics, Tropical (Gr. *tropikos*, from *trepo*, I turn).—Those two circles on the earth's surface over which the sun seems directly to pass when he is at the greatest distance from the equator—viz., 23½ degrees; hence the one is called the northern tropic or Tropic of Cancer, and the other the southern or Tropic of Capricorn. The zone or belt of the earth within these circles is said to be "within the tropics" or "*tropical*," and constitutes the Torrid Zone of climatologists. Plants, animals, climate, and other phenomena occurring within this region, are said to be *Tropical*; those on the extreme temperate verges of the region, *Sub-tropical*.

Tropifer (Gr. *tropis*, keel, and *fero*, I bear).—A minute crustacean from the Lias bone-bed of Aust Passage; so called from its keeled carapace.

Trouble.—A mining term for any faulting or shifting of the strata of a coal-field by which the regular and continuous working of its minerals is interrupted. A field so faulted is said to be troubled.—See **FAULT**.

Trough.—A familiar term for any sudden depression of strata by which they are made to assume the basin-shaped or synclinal arrangement. Generally used as synonymous with *basin* or *syncline*.

Trough-Joint.—The fissure or joint which frequently accompanies the abrupt bending of strata passing through the middle of the curvature.

Tubbing.—The technical term for the lining of a shaft with wood or iron, for the purpose of preventing the falling in of loose incoherent strata or of excluding the water that may flow in from the sides. In many instances this casing requires to be of iron, water-tight, and of the most substantial description.

Tubiporites (Lat. *tubus*, a tube, and *porus*, a pore).—Parkinson's term for a genus of fossil corals composed of closely-united calcareous tubes—each tube having been the abode of an individual polype. Now known as *Syringopora*, which see.

Tuff, Tufts (Ital. *tufo*, Gr. *tophos*).—Originally applied to a light porous rock composed of cemented scoriæ and ashes; but now used for any porous vesicular compound, as *calc-tuff*, *trap-tuff*, *volcanic tufts*, &c.; which see.

Tungsten (Swedish, heavy-stone).—A hard brittle metal, of a light steel-grey colour and brilliant metallic lustre, having a specific gravity of 17.5. It is barely fusible at the greatest heat of the smith's forge, but when heated to redness in the open air it is converted into the peroxide (tungstic acid). Its ores, tungstates of lime, iron, and manganese, are very frequently associated with those of tin, which they greatly injure. These are *wolfram*, tungstate of iron and manganese; *stolsite*, tungstate of lead; *scheelite*, tungstate of lime; and *tungstic ochre*. The metal is not used in

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the arts; but tungstic acid is employed in dyeing. It was discovered by Scheele in 1781; hence the occasional early synonyme of *Scheelium* or *Scheelite*.

Tunicata (Lat. *tunica*, a coat or tunic).—A class of headless molluscs, which have no shells, but are protected instead by an elastic, leathery-looking tunic; hence the name. The *tunicaries* have no organs of locomotion, but are found floating freely in the ocean, or fixed to rocks, shells, sea-weeds, and the like. They are hollow, and have two orifices from which they squirt the water after it has served the purposes of respiration and nutrition, and this forcible ejection assists in propelling those that are free floaters. They are divided into two great groups—the *fixed* or *Ascidians*; and the *free-floating* or *Salpians*, which see.

Turbinated (Lat. *turbo*, a whipping-top).—Top-shaped; generally applied to those univalve shells which, like the winkle and garden-snail, have a spiral top-like form.

Turbinidae (Lat. *turbo*, a whipping-top).—An extensive family of gastropod molluscs, of which the common *turbo* or "top-shell" has been taken as the type. The Turbinidae (which include the genera *turbo*, *phasianella*, *trochus*, *euomphalus*, &c.) have spiral, top-shaped, or pyramidal shells; more or less pearly inside; and furnished with a calcareous or horny operculum. They are marine, littoral in their habits, feed on sea-weeds, and have a world-wide distribution.

Turbo (Lat., a whipping-top).—The common top-shell, a genus of gastropod molluscs, embracing about 60 living species found in all seas; and upwards of 360 fossil species (including littorina) found from the Lower Silurian upwards.—See **TURBINIDÆ**.

Turin Nuts.—A familiar term for the fossil fruits of a species of Walnut which occurs in the newer Tertiary deposits in the neighbourhood of Turin. "The ligneous envelope," says Mantell, "has perished, but the form of its surface, and of the enclosed kernel, is preserved in calcareous spar.

Turkey-Slate, Turkey-Stone.—A familiar term for *whetslate*, *novaculite*, or *honestone*, some of the best varieties being imported from Turkey, where it occurs of a remarkably fine and even grain, and of a greenish-grey or slightly yellowish colour.

Turquois.—The *uncleavable azure-spar* of Mohs, and the *Calaite* of other mineralogists; a phosphate of alumina with a little phosphate of iron and copper; occurring amorphous, reniform, stalactitic or incrusting; and usually of a beautiful sky-blue or greenish-blue colour. It takes a fine polish, and is highly prized as an ornamental stone. It is found in veins in flinty slate, but many of the finest Oriental turquoises are gathered as pebbles from the alluvium of Persia and Syria; and it is said that fossil teeth and bones coloured by hydrated copper oxide or phosphate of iron from Nuash in Siberia and Trevaux in France, and known as *Odontolite*, are often substituted for the true mineral.—See **ODONTOLITE**.

Turritelite (Lat. *turris*, a tower, and *lithos*).—An extinct genus of chambered shells belonging to the Ammonite family, and characterised by their straight, spiral, turreted contour. They seem restricted to the Chalk formation, in which from twenty to thirty species have been detected.

Turritella (Lat. dim. of *turris*).—A genus of marine gastropods, the type of the family *Turritellidae*, and so called from their turriculated shape, the shell being elongated, many-whorled, spirally striated; aperture rounded, margin thin; operculum horny, many-whorled; with a

fine briated margin. The living species, familiarly known as *screw-shells*, are about fifty in number, and have a world-wide distribution; the fossils, more than one hundred and fifty, are found from the Lower Greensand upwards. They are inhabitants of deepish water ranging from three to one hundred fathoms.

Turtle-Stones.—A familiar appellation for those nodular concretions commonly known as *Ludi Helmontii*, septaria, and the like.—See SEPTARIA.

Tympanophora (Gr. *tympanon*, a cymbal, and *phoreo*, I bear).—A term applied to certain fossil plants, chiefly from the Oolite, having minute branching stems, each branchlet being terminated by a rounded or globular appendage resembling a seed-vessel. Nothing is known of their nature, or of that of *Sphaeræda*, which they somewhat resemble.

Typhoon (Gr.)—Literally, a tempest or whirlwind. *Typhoons*, the name given by navigators to the hurricanes that visit, generally from June to November, the seas of Southern China, and the adjacent archipelagoes of the Philippines and Moluccas.

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Ulmannite (after Ulmann).—An ore of nickel and antimony found chiefly in the copper-mines in the transition rocks of the Westerwald. It is of a bluish-grey colour, and consists of 26.8 nickel, 58.6 antimony, and 14.6 sulphur, but part of the antimony often replaced by arsenic.

Ulodendron (Gr. *kule*, a wood, and *dendron*, tree).—A genus of Coal-measure trunks, often of considerable size, and characterised by their stems not being furrowed, but covered with rhomboidal scales, and having on opposite sides two vertical rows of large circular scars, to which cones had been attached. In *Bothrodendron* (which see) the stem is dotted; and the cone-scars are obliquely oval.

Ulna, Ulnar (Lat. *ulna*, the cubit or large bone of the fore-arm).—The two bones that form the fore-arm, or that portion between the wrist and elbow, are termed the *ulna* and *radius*, the *ulna* being the larger of the two.

Ultramarine.—Literally “beyond the seas;” a well-known blue pigment of great beauty and permanence, and until lately prepared from the *lapis lazuli*—the finest specimens of which were brought from China and Further Asia; hence the name. It is now artificially prepared by the chemist, after a mode originally discovered by Gmelin. The artificial, which can be made cheaply and in any quantity, consists of 46.60 silica, 3.83 sulphuric acid, 23.30 alumina, 21.48 soda, 1.06 peroxide, with traces of lime, magnesia, and sulphur.—See LAPIS LAZULI.

Umber (Lat. *umbra*, shade, hue).—A well-known pigment of various shades of brown; occurring either naturally in veins and beds, or prepared artificially from various admixtures. The “*umber*” proper of the mineralogist is a soft earthy combination of the peroxides of iron and manganese, with minor proportions of silica, alumina, and water. It is usually found in veins in the transition and crystalline strata, and appears

to be a product of decomposition. Much of the umber of commerce, however, is a mere ochraceous admixture; and that from Cologne is said to be only brown-coal finely pulverised.

Umbo, plural **Umbones** (Lat.)—A boss or protuberance. In conchology, that knob-like point of a bivalve shell which is situated immediately above the hinge. **Umbonated**.—Bossed; knobbed in the centre.

Umbral (Lat.)—Shady, belonging to the dusk; the fourteenth of the fifteen series into which Professor H. D. Rogers subdivides the Palaeozoic strata of the Appalachian chain—the “Dusk” of the North American Palaeozoics, and the equivalent, in part, of our Carboniferous Limestone and Lower Coal-measures.—See PALÆZOIC FORMATIONS.

Unconformable.—Strata lying parallel on each other are said to be *conformable*; but when one set is laid on the upturned edges of another set, they are *unconformable*. Unconformability is generally taken as evidence of a break in geological sequence—the underlying set having been deposited, consolidated, and upturned, before the deposition of the unconformable or overlying strata.

Unctuous (Lat. *unctus*, anointed, greasy).—Many minerals, such as steatite, talc, serpentine, and the like, when rubbed between the fingers, have an *unctuous* or greasy feel—a character which is often useful in discriminating species. Most of the magnesian minerals have this *feel*, which is altogether different from that produced by mere smoothness.

Underclay.—A term now generally applied to those argillaceous beds which immediately underlie seams of coal. These underclays are usually tenacious, more or less bituminous, and almost always interpenetrated by stigmata roots. Every seam of coal has not an underclay; but where they exist they seem to have been the ancient soil or mud on which the vegetation of the coal-bed flourished.

Undercliff.—The term applied to a cliff when the upper part has fallen down along a considerable line of coast, and forms a subordinate terrace between the sea and the original shore.

Underlie, Underlay.—In mining, the dip or inclination of a mineral vein viewed from above downwards.

Under-tow.—A nautical term for any decided under-current of water. Thus, in the ordinary breaking of waves, the wave advances, crests, makes its plunge, and then its waters flow back beneath those of the next wave—in general, producing a strong under-current or *under-tow*.

Undulation (*unda*, a wave—*undula*, a little wave).—Alternate elevations and depressions of strata are spoken of as *undulations*; ridged or wavy surfaces are said to be *undulated*.

Ungulite Grit.—A series of greenish-coloured shales and grits occurring near St Petersburg (probably of Lower Silurian age); and so termed because their prevailing shell is the *Obolus* or *Ungula*, a nail-shaped brachiopod of the Lingula family.

Uniclinal.—In most instances when strata are bent or curved a syncline or trough accompanies an anticline or saddle; but in some instances there is simply one great elevation or depression, after which the rocks regain their normal inclination, and to this solitary bending the term *uniclinal* has been applied by Mr Darwin and others.

Uniformitarian.—In geology, one who holds the doctrine that the laws of nature have acted uniformly throughout all time past, and that the appearances in the earth's crust, however difficult of solution, are to be

ascribed to the uniform action of these laws, and not to revolutionary or cataclysmal operations.

Uniónids (Gr. *unio*, a pearl).—The family of River-mussels, found in the ponds and streams of all parts of the world. They have a solid, pearly shell, with two principal and two lateral teeth on the hinge; and their umbones or bosses are generally smooth or longitudinally laminated. Those which have no cardinal teeth are arranged under the genus *Anodon*. Of the *Unio*, which is taken as the type of the family, there are about 250 living species; and about fifty species have been found fossil from the Carboniferous formations upwards. There is considerable doubt, however, whether the Carboniferous shells really belong to the genus *Unio*; some geologists refer them to *Cardinia*, and commence the Uniones with the Wealden.

Univalve (Lat. *unus*, one, and *valva*, a lid or valve).—Applied to molluscous animals or "shell-fish" whose shell consists of a single piece, as the periwinkle, limpet, &c.; in contradistinction to *bivalves*, like the cockle and mussel, whose shell consists of two valves or pieces. According to the Linnean arrangement shells consisted of three orders, *univalves*, *bivalves*, and *multivalves*; but these divisions are now little attended to except in popular description. The univalves are usually spoken of as "turbinated" or those having a spire, and those without a spire. Palæontologically, the gasteropods or true univalves have been on the increase since palæozoic times, till now in the current epoch they constitute the most numerous class of mollusca both in genera and species.

Unstratified.—Applied to rocks which do not occur in layers or strata, but in amorphous masses; and as this is a feature of igneous rocks, the term is usually regarded as synonymous with *igneous*. Hence we speak of aqueous or *stratified* rocks, and of igneous or *unstratified* rocks; though, strictly speaking, many igneous products, as flows of lava and trap, showers of dust and ashes, &c., occur in stratiform or sheet-like accumulations. "The terms *stratified* and *unstratified*," says De la Beche, "have been commonly considered as respectively synonymous with aqueous and igneous. Practically this division is highly valuable; but theoretically it is not so satisfactory, at least if we are to infer that all rocks divided into tabular masses, one resting on another, must have been deposited either chemically or mechanically from water. We should be careful not to couple too far stratification with aqueous deposition, as sheets of igneous rocks may cover pre-existing sheets of similar rocks, and the result be stratification."

Upheave, Upheaval, Uplift.—A lifting up of strata by some expansive or elevating power from below. The terms *upthrow* and *downtthrow* are more generally used to designate such subterranean movements.

U'ranite.—Known also as *uran-mica*, *uran-glimmer*, and *lime-uranite*; a mineral occurring in flat tabular crystals of a sulphur-yellow to siskin-green colour, and consisting, according to Berzelius, of 15.5 phosphoric acid, 62.6 peroxide of uranium, 6.2 lime, and 15.7 water. It is found chiefly in granitic rocks, and occasionally in veins and beds in the crystalline strata with other ores. It is a calcareo-phosphate of uranium, and differs from *chalcolite*, which is a cupreo-phosphate, only in containing lime instead of copper.

Urániun.—A metal discovered by Klaproth in 1789, and so named by him after the planet Uranus, which was discovered in the same year. It

URA — VAL

is obtained from several mineral species, and is, when separated, a powdery substance of a greyish black colour, with a metallic lustre, very combustible, and burning with a white light. It is separated with great difficulty; is infusible; and has a specific gravity of 9.0. Preparations of uranium are used for imparting fine orange tints to glass and porcelain enamel; and the uranite of potash affords a splendid orange to the artist. The various minerals containing uranium are in general easily distinguished by the hues of yellow they communicate to glass. The following are the principal:—1. *Uranium ore*, *pechurane*, or *pitchblende*; 2. *Uranite*, *uran-mica*, *uran-glimmer*, or *lime-uranite*; and, 3. *Chalcolite*, or *copper-uranite*.

Uran Ochre or Uranium Ochre.—Earthy oxide of uranium, occurring in soft friable masses, disseminated or encrusting, along with pitchblende or protoxide of uranium, in the granites of Saxony and France. It has various hues of yellow and orange, and seems derived from the decomposition of the protoxide.

Urao.—A native term for the carbonate of soda found in crystalline crusts on the dried-up lakes and river-courses of South America; same as the *Trona* of the Arabs, which see.

Urchin (Lat. *erinaceus*, the hedgehog).—The name of “sea-urchin” has been given to the *echinus*, on account of its prickly ambulacral spines.—See ECHINIDA.

Urostheneas (Gr.)—Literally “strong-tail;” a genus of fishes from the Carboniferous strata of New South Wales, and so named by Professor Dana from its powerful heterocercal tail. In general form of the body, the large size and backward position of the dorsal and anal fins, the genus resembles *Pygopterus*; but differs in having these organs placed directly opposite to each other, in their being shorter and nearer the tail, and also in having the scales smooth.—See PYGOPTERUS.

U'rsidae (Lat. *ursus*, a bear).—The Bear tribe; a well-known family of carnivorous mammals, having a wide range both in the old and new worlds, and particularly in the northern hemisphere. The remains of several species (*U. spelæus*, *priscus*, &c.) have been found in the caves breccias, and alluvia of the Pleistocene period.

Urus.—The Ure-ox or *Bos urus*, described by Cæsar in his ‘Commentaries,’ and stated to abound during his invasion in the forests of Gaul and Germany. It has been long quite extinct in all parts of Europe, and is supposed to be the same as the *Bos primigenius*, whose remains occur in Post-tertiary deposits. Often confounded with the Auroch or Bison of northern Europe, which still lingers in a protected state in the Imperial forests of Russia.

V

Valentinite (after Valentine).—White oxide of antimony; a mineral occurring crystallised, or massive and disseminated in granular, columnar, and foliated aggregates; usually of a whitish-grey colour, and consisting of 84.32 antimony and 15.68 oxygen. It is found in veins in the primary rocks along with other ores of antimony, lead, and zinc.

VAL — VAR

Valley (Lat. *vallis*).—Any hollow or low-lying tract of land bounded by hill or mountain ranges; and usually traversed by a stream or river which receives the drainage of the surrounding heights. We have thus "circular valleys," "longitudinal valleys," and "cross valleys," according to the configuration and disposition of the bounding heights; though, generally speaking, longitudinal valleys, taking their names from the rivers which flow through them, are the most characteristic and common. A level tract of great extent, and traversed by more rivers than one, is, properly speaking, not a valley, but a *plain*; and deep narrow river-courses, on the other hand, are more correctly designated *glens*, *ravines*, and *gorges*. Geologically speaking, valleys take their rise from original inequalities of the surface produced by subterranean movements; or they are the result of long-continued erosion by river-currents, and thence known as "Valleys of Erosion."—(See EROSION.) Occasionally we meet with such terms as "Valley of Elevation," and "Valley of Denudation"—the former being a huge fracture or rent produced by subterranean upheaval, and from which the strata dip away on either side; the latter being a mere valley of erosion scooped out by the action of water without disturbing the original position of the strata, which are continuous on both sides.

Vanadinite.—The vanadate of lead, a rare mineral occurring in crusts of small hexagonal prisms, of a yellowish-brown colour and resinous lustre, chiefly along with other ores of lead, as at Wanlockhead, Matlock, Wicklow, and in auriferous veins in Siberia and Mexico. It consists, according to Thomson, of 66.3 oxide of lead, 7.06 lead, 23.44 vanadic acid, and 2.45 chlorine.

Vanadium.—A rare metal of a greyish silvery colour, discovered by Sefström in 1830, in the iron prepared from the iron-ore of Taberg in Sweden, and named after *Vanadis*, a Scandinavian deity. It has since been found in the form of vanadate of lead or *vanadinite*, a mineral occurring in many localities. As a metal, the properties of vanadium are yet little known.

Variables.—Near the equator the trade-winds, north and south of it for a certain distance, completely neutralise each other, and the zone of calms and light breezes so formed is known as the *Variables*.

Variegated Sandstone.—The New Red Sandstone of English geologists; the *grès bigarré* of the French; and the *bunter sandstein* of the German. It is also termed by some the *Poikilitic* (variegated) System, in allusion to its mottled and particoloured shales and sandstones.

Variety (Lat. *varius*, changeable).—In natural history, a subordinate division of a *species*, distinguished by some accidental or unimportant differences, not considered essential to the main and permanent characteristics of the species. Some slight difference in colour, in size, or in the greater or less development of some particular organ, may constitute a *variety*, while it may not affect the permanent characteristics of the species.

Variolite (Lat. *variola*, small spots).—The name given to those varieties of compact amygdaloid or amygdaloidal porphyry, in which the enclosed crystals are numerous, small, and round, giving to the rock a spotted appearance. This appearance is often rendered more striking from the matrix of the rock being of a different colour from the enclosed crystals.

Variolitic.—Spotted; thickly marked with small round specks. Applied to rocks having the aspect of *Variolite*, or small-grained amygdaloidal porphyry.

Vascular (Lat. *vasculum*, a little vessel).—Composed of small vessels, like the woody tissue or substance of flowering plants; and used in contradistinction to *cellular*, which denotes that the substance is built up of uniform cells, and consequently softer and less durable in structure. *Vascularity* indicates a higher degree of organisation than simple *cellularity*.

Vasodentine (Lat. *vas*, a vessel, and *dens*, tooth).—An anatomical term employed to express that modification of *dentine* (see **TEETH**) in which capillary tubes of the primitive vascular pulp remain uncalcified, and carry red blood into the substance of the tissue. They form the so-called vascular or medullary canals, and are usually more or less parallel in their course. A large proportion of the central part of the tooth of the sloth and megatherium consists of vaso-dentine, and a smaller proportion of the same part of the tusks of the elephant and of the chisel-like incisors of the rodents.

Vaquelinite (after Vauquelin the chemist).—A chromate of lead and copper occurring in veins with other ores, in minute tabular crystals, or in mammillary crusts, of a dark olive-green colour, and resinous lustre. Consists of 60.87 lead protoxide, 10.80 copper protoxide, and 28.33 chromic acid.

Vein (Lat. *vena*).—Applied in geology to all fissures and rents in the earth's crust filled with mineral or metallic matter, differing from the rock-mass in which they occur—these subsequently filled fissures traversing and ramifying through the solid rock, like the *veins* through the living system. When such fissures are filled with granite, greenstone, claystone, or with other massive rock-matter, whether igneous or otherwise, they are all usually termed "dykes;" but when containing metalliferous ores or crystalline minerals, they receive the name of "veins" or "lodes;" and "false veins" when they are merely rents or fissures filled with debris from above. The subject of veins is one of the most difficult and complicated—and interesting because difficult and complicated—within the whole range of geology. It embraces the following questions or branches of research:—1. The nature of the substances occurring in mineral veins; 2. The mode or modes in which these substances were aggregated; 3. The situations of their occurrence, and the nature and age of the rock formations in which they occur; 4. Their frequency in any given district, and the directions they take—that is, whether they all trend in one way, or cross and intercross; 5. Their relative ages, so as to erect them into separate "Systems," and thus be enabled to apply such knowledge to their economical exploration. Such an inquiry involves, of course, much patient observation in geology, an intimate acquaintance with mineralogy, and, above all, a knowledge of those chemical and electrical forces which are continually acting, and must have similarly acted in all time past, in decomposing, dissolving, segregating, and reconstructing the mineral and metallic constituents of the earth's crust. For a brief and intelligible review of the theory of mineral and metallic veins, see Professor Phillips's 'Manual of Geology,' in 'Encyclopedia Metropolitana,' together with the various authorities therein referred to.

Veined.—Streaked; marked, like some marbles, with lines or veins of colour, either parallel to, or crossing each other.

Veinstone.—The stony or mineral matter occupying a vein, in contra-

distinction to the metallic or metalliferous ores of which it forms the *matrix*. Known also as *Veinstuff*.

Veinstuff.—The usual mining term for the rock-matter—technically the *matrix* or *gangue*—which fills a vein, and through which the ore is disseminated in crystals, nests, strings, ribs, and other forms. This vein-stuff or matrix may be either crystalline or amorphous.

Ventral (Lat. *venter*, the belly).—Of or belonging to the belly; *e.g.*, the ventral or belly fins of fishes, as distinguished from the dorsal or back fins.

Véntricos (Lat. *venter*, the belly).—Bellying; swelling or bulging out in the middle; generally applied to hollow bellying forms.

Ventriculite (Lat. *ventriculus*, a ventricle or sac).—The name given to certain fossil zoophytes of the Chalk, usually appearing as fungiform flints, and well known to the inhabitants of Kent and Sussex as “petrified mushrooms.” Palaeontologists are not agreed as to the precise nature of the ventriculites, which seem to have been of a spongiform flexible texture, and to have consisted of a hollow cup-like expansion, tapering to a point below, and attached by fibrous rootlets to other bodies.

Verd Antique (Ital. *verde antico*).—A clouded green marble, consisting of an admixture of serpentine and limestone, found at Genoa and in Tuscany, and much prized for its beauty.

Verde di Corsica Duro.—A rock found in the island of Corsica, of a changing green colour, composed of Diallage and Labrador felspar, and used for vases, inlaying, and other ornamental purposes.

Vérdiris (Fr. *verde-gris*, green-grey).—A sub-acetate of copper, formed by bringing the surface of the metal in contact with acetic acid; and so called from its peculiar green colour. A rust of copper, or *Ærigo*, which see.

Vérditer.—A blue pigment, prepared by adding finely-leigated chalk or “whiting” to a solution of copper in aquafortis.

Vergent (Lat.).—Drawing to a close; the eleventh of the fifteen series into which Professor Rogers subdivides the Palæozoic strata of the Appalachian chain—the “Descending Day” of the North American Palæozoics, and the equivalents of our middle Devonians.—See PALÆOZOIC FORMATIONS.

Vermiculite (Lat. diminutive of *vermis*, a worm).—A mineral substance composed of minute micaceous plates disseminated through a mealy magnesian matrix, and having a soapy lustre and greasy feel. It consists of silica, magnesia, iron peroxide, alumina, and a trace of manganese. When heated to redness it swells out with a vermicular motion, as if it were a mass of small worms; hence the name.

Vermiculites (Lat. *vermis*, a worm).—Applied to the smaller and shorter worm-tracks which appear on the surfaces of many flaggy sandstones.

Vérmiiform (Lat. *vermis*, a worm, and *forma*, shape).—Worm-like; worm-shaped. Vermiform casts and impressions occur in the sandstones of various formations; some apparently the true rejectamenta of annelids, like the earth- and lob-worm; others their tortuous tubes and burrows; and many their mere superficial tracks or trails.—See ARENICOLITES, FORALITES, SCOLITES, &c.

Vermilion.—A well-known brilliant red pigment, prepared by pulverising the red sulphuret of mercury, or *Cinnabar*, which see.

Vértebra (Lat., from *verto*, I turn).—A single bone of the backbone or

spinal column. The different vertebrae comprising the backbone are usually divided into *cervical* or those of the neck, *dorsal* or those of the back, *lumbar* or those of the loins, and *caudal* or those prolonged into a tail in many classes of animals. Important distinctions are also founded upon the mode in which the several vertebrae are attached or jointed to each other—some being concave before (*procelian*), others being concave at both ends (*amphicealian*), and others flat in front and concave behind (*platycoelian*).

Vertebrata (Lat. *vertebra*, the joint of a backbone).—One of the two grand divisions of the animal kingdom, including all those animals furnished with *vertebrae* or backbones. In Cuvier's arrangement the *Vertebrata* embrace the Mammals, Birds, Reptiles, and Fishes; the *Invertebrata* the Articulata, Mollusca, and Radiata.—See tabulations, "ANIMAL SCHEME."

Vesicular (Lat. *vesicula*, a little bladder).—Full of bladder-like cavities; composed of cells or vesicles. Applied to rocks full of little cavities, as vesicular lava, vesicular trap-tuff, &c.—these cavities having arisen from the disengagement of gases when the rock-matter was in molten state.

Vespertine (Lat.)—Of or belonging to the evening; the thirteenth of the fifteen series into which Professor H. D. Rogers subdivides the Palæozoic strata of the Appalachian chain—the "Evening" of the North American Palæozoics, and the equivalents of our Lower Coal-measures or Carboniferous slates.—See PALÆOZOIC FORMATIONS.

Vesuvian.—A reddish-brown mineral of the Garnet family; so called from its being found in volcanic rocks, and in particular those of Vesuvius. Same as pyramidal garnet or *Idocrase*, which see.

Vibratile Organs (Lat. *vibro*, I move quickly or vibrate).—A common designation for those hair-like organs of motion with which so many of the lower aquatic animals are furnished; and termed *CILIA*, which see.

Vitreous (Lat. *vitrum*, glass).—Having the lustre or aspect of glass; glassy. **Vitrify**.—To melt or convert into glass. **Vitrified**.—Having the surface coated with or partially converted into glass by the action of heat.

Vitrification (Lat. *vitrum*, glass, and *fic*, I become).—The conversion of any mineral substance into glass; hence we speak of "vitrified forts," of the "vitrification of rocks," &c., when by the action of heat their surfaces are covered with a *glass* or *glassy* coating, produced, as glass is, by the fusion of silica along with an alkaline flux.

Vitriol (Lat. *vitrum*, glass).—A term applied by the earlier chemists to all crystalline bodies having a certain degree of transparency, but now mainly restricted as a familiar designation for the following substances:—viz., *blue vitriol*, sulphate of copper or cyanose; *green vitriol*, sulphate of iron, copperas, or melanterite; *white vitriol*, sulphate of zinc or goslarite; *red vitriol*, sulphate of the proto-peroxide of iron and magnesia or botryogene; and *oil of vitriol*, or sulphuric acid, so called because originally distilled from green vitriol or copperas.

Vivianite.—A mineralogical term for *phosphate of iron*, which occurs in prismatic crystals, in fibrous reniform crusts, also massive, disseminated, and earthy; usually of a fine indigo blue; found in metalliferous veins, as well as a recent formation in connection with decomposed animal matter. It is sometimes used as a pigment.

Viviparous (Lat. *vivus*, alive, and *pario*, I bring forth).—Animals

which bring forth their young alive and perfect, are said to be *viviparous*, in contradistinction to the *oviparous*, or those which produce their young in the egg.

Volcánic (*Vulcanus*, god of fire).—Igneous action apparent at the surface of the earth, in contradistinction to *Plutonic* (which see), or that taking place at great depths in the interior. *Volcánic*, as applied to rocks, embraces all igneous products of recent or modern origin, as distinct from Trappean and Granitic. Cosmically speaking, volcanic activity seems to have been most manifested in the northern hemisphere.—See **IGNEOUS ROCKS**.

Volcánic Bombs.—Bomb-like masses of lava, frequently occurring in great numbers in the vicinity of active volcanoes. Speaking of those on the island of Ascension, Mr Darwin remarks:—"They vary in size from that of an apple to that of a man's body; they are either spherical or pear-shaped, or with the hinder part (corresponding to the tail of a comet) irregular, studded with projecting points, and even concave. Their surfaces are rough, and fissured with branching cracks; their internal structure is either irregularly scoriaceous and compact, or it presents a symmetrical and very curious appearance, which is very simply explained, if we suppose a mass of viscid, scoriaceous matter to be projected with a rapid rotatory motion through the air."

Volcánic Cones.—The name usually given to volcanic hills of active or of recent eruption. These cones are generally spoken of as *lava cones*, having a gentle slope and pit-like crater of eruption; *tufa cones*, having a steep slope and saucer-shaped crater; *cinder cones*, having a still steeper slope and narrow crater; and *mixed cones*, formed partly of lava and partly of tufa and cinders, and varying in aspect according as one other ingredient predominates or has been the latest erupted.

Volcánic Foci (Lat. *focus*, a fire, the point of greatest intensity).—Subterranean centres of igneous action, from which minor exhibitions diverge.

Volcánic Mud.—The foetid sulphureous mud discharged by volcanoes, especially those of South America.—See **CANGANA** and **MOYA**.

Volcáno (Lat. *Vulcanus*, the god of fire).—A volcano has been described by Sir Charles Lyell as "a more or less perfectly conical hill or mountain, formed by the successive accumulations of ejected matter in a state of incandescence or high heat, and having one or more channels of communication with the interior of the earth, by which the ejections are effected." Mr Scrope, who has directed much attention to volcanic phenomena, remarks that "a volcanic 'cone of eruption,' in its normal form, with a 'crater' or cup-shaped hollow at its summit, is the result of the accumulation round the volcanic orifice or vent of the scorïæ, and other fragmentary matters projected into the air by the series of explosive discharges of elastic vapour and gases which usually characterise an eruption. The fragments which fall back into the vent are, of course, thrown up again and again, and trituated into gravelly sand or fine ashes by the friction attendant on this violent process. Those which fall on the outside of the vent are heaped up there in a circular bank, the sides of which, both within and without, slope at an angle rarely exceeding 33°. And this bank, viewed externally, has of course the shape of a truncated cone—the crater being a hollow inverted cone contained within it."

Volkmannia (after Volkmann).—A provisional genus of Coal-measure

stems having verticillate or whorled leaves, and bearing cones on their extremities. They are regarded as *asterophyllites* in fructification.

Vóltzia (after Volts of Strasburg).—A genus of coniferous plants peculiar to the Permian and Triassic formations. They greatly resemble *araucaria* in the form and imbrication of their leaves, which are inserted all round the pinnated branches, are sessile, slightly dilated at the base, and almost conical. Fruit in spikes or loose cones.

Vóltzine or **Vóltzite** (after Volts).—Oxysulphuret of zinc, occurring in small hemispherical incrustations, in quartz veins, and usually coloured brown or brownish-red by the presence of a small percentage of iron peroxide.

Vóraulite.—An occasional synonyme for the ferro-magnesian silicate of alumina, better known as *blue-spar*, *azurite*, or *lazulite*—from its occurring at Vórau in Styria.—See LAZULITE.

Vúlcánism or **Vúlcánicity** (Lat. *Vulcanus*, the god of fire).—A general term adopted by Humboldt, and made use of in his 'Cosmos,' to embrace "the entirety of those telluric phenomena which are to be ascribed to the constantly active reaction of the interior of the earth upon its external crust or surface." Thermal springs, gas and mud volcanoes, burning springs and salses, and the large burning mountains or volcanoes proper, are thus brought under one category; and he regards it "as advantageous to avoid the separation of that which is casually connected, and differs only in the strength of the manifestation of force and the complication of physical processes." The term has not yet been adopted by English geologists; and it must be confessed that there is considerable difficulty in associating phenomena which seem to depend on some deep-seated source of heat within the globe, with those that may arise from heat, chemically or otherwise generated, in the mere exterior or superficial crust.

Vúlcánista.—Applied to those geologists who opposed the Wernerian or Neptunian doctrine, that all rocks were of aqueous origin, and who contended for the presence of igneous action in the formation and modification of the earth's crust.

Vúlcánite.—An occasional synonyme of *Pyroxene* or *Volcanic garnet*, from its occurrence in ejected blocks and lavas.

Vúlpinite.—A granular variety of anhydrous sulphate of lime or gypsum, so called from its being found at Vulpino in Italy, where it is polished for ornamental purposes, under the name of *marmo bardiglio*.

W

Wacké.—A German miner's term for a soft earthy variety of trap-rock, resembling indurated clay, but generally containing crystals peculiar to the Trap series. It is usually of a greyish-green colour, from the amount of earth it contains, is sometimes amygdaloidal, and readily crumbles down when exposed to the weather. It seems to be, in some instances, a compacted mass of volcanic dust and ashes; in others, an indurated volcanic mud.—See GREYWACKE.

Wad or Wadd.—A miner's term for an earthy oxide of manganese, occurring in beds and incrusting veins and fissures in the older rocks. It is used chiefly as a coarse pigment in oil-painting; for colouring and glazing pottery; and in the manufacture of glass. When mixed with linseed oil, the ochrey variety often takes fire spontaneously.

Wagnerite (after Dr Wagner).—The fluophosphate of magnesia, a transparent mineral, having a vitreo-resinous lustre, wine-yellow or honey-yellow colour, and at one time confounded with the Brazilian topaz. It is very rare, and has been found only near Werfen in Salzburg, in quartz-veins in the Clay-slate formation.

Walchia (after Walch).—A genus of coniferous plants occurring in the Carboniferous and Permian systems. According to Sternberg, who erected the genus, they have numerous closely-set, regularly-pinnated branches, resembling those of *Araucaria excelsa*, and which are thickly beset with foliage. In many instances the branches are terminated by oblong cones, composed of imbricated, oval, or lanceolate pointed scales.

Warp.—A provincial term for the muddy deposit from waters artificially introduced over low lands, as those adjoining the Trent, Ouse, &c. The process of *warping* consists in causing water loaded with silt to enter low flats at flood-tides, there to remain till it has deposited its mud, and afterwards allowing it to run off clear when the tides are low. It is an important means of fertilising, as well as of raising the general level of large low tracts.

Waste.—In mining, the old neglected workings of a coal-mine; so called from their being unattended to in ventilation, drainage, and other particulars.

Water.—In chemical nomenclature water is the *protoxide of hydrogen*, consisting of two volumes of hydrogen and one of oxygen, or of eight parts of oxygen to one of hydrogen by weight—88.9 oxygen, and 11.1 hydrogen. When pure and at ordinary temperatures, it is fluid and amorphous, without taste or smell, colourless in small quantities, but in large masses of a peculiar green or blue. The specific gravity of pure or distilled water, at 62° Fahr., is assumed at 1.000, and is taken as the standard of gravity for all other bodies; but sea-water varies according to locality, and the depth from which it is taken, from 1.027 to 1.029. When heated to the temperature of 212° Fahr., at the level of the sea and under the ordinary pressure of the atmosphere, water boils and is converted into steam; and this *boiling-point* (as it is termed) becomes less in proportion as we ascend above the sea-level. At 40° Fahr. water is at its minimum volume, expanding as it rises above that temperature till it is wholly converted into vapour, and also, as it falls below it, till it is converted into *ice*—a transparent, brittle, crystalline solid. Water, as found on the earth, is never absolutely pure, but contains more or less of various substances, as atmospheric air, carbonic acid, nitrogen gas; silica, alumina, and salts (carbonates, sulphates, nitrates, phosphates) of lime, magnesia, soda, potash, protoxide of iron and manganese; or chlorides and fluorides of their metallic bases; and in the sea and some saline springs, also iodine and bromine. As a geological agent, water may be regarded in three main lights—*vis.*, *vitally*, as indispensable to the life and growth of plants and animals; *chemically*, as entering less or more into the composition of all inorganic or mineral bodies; and *mechanically*, as abrading, transporting, and reasorting the materials of

the earth's crust, by its operations in rain, rivers, waves, tides, and other currents.

Water of Crystallisation.—Many substances, in passing from a state of solution to the solid crystalline form, combine chemically with a certain portion of the water, which in a dry state forms an essential part of their crystals, and seems, in some cases, to give the peculiar determination to their constituent molecules; the amount of this water is the "water of crystallisation."

Watershed.—In physical geography, the ideal line which separates two river-basins or systems of natural drainage—all the springs and streamlets "shedding off," like the roof of a house, as it were, to their respective basins. The watershed is not necessarily a mountain-chain, and in some rare instances it is broken by a water-communication connecting two great river-systems.

Waterspout.—"The waterspouts so frequently seen in the ocean originate," says Mrs Somerville, "in adjacent strata of air of different temperatures, running in opposite directions in the upper regions of the atmosphere. They condense the vapour and give it a whirling motion, so that it descends tapering to the sea below, and causes the surface of the water to ascend in a pointed spiral till it joins that from above, and then it looks like two inverted cones, being thinner in the middle than either above or below. When a waterspout has a progressive motion, the upper and under part must move in the same direction and with equal velocity, otherwise it breaks, which frequently happens."

Water-worn.—Worn away, smoothed and rounded by the action of water, as the "shingle" in the bed of a river, or the "pebbles" on the sea-shore. *Water-worn* blocks are generally smooth and rounded in form; *weather-worn*, rough, and more or less honeycombed.

Wavellite (after Dr Wavel, its discoverer).—Phosphate of alumina; a transparent yellowish-grey or greenish-grey mineral, occurring in minute acicular crystals, which unite in hemispherical masses, with a radiated fibrous texture and drusy surface. It is found in various formations, but chiefly in clay-slate and other older rocks; and is sometimes confounded with *Hydrargillite*, which is a pure hydrate of alumina.

Wayboards.—A mining term, now pretty generally employed by geologists to designate any thin layers or bands that separate or define the boundaries of thicker strata; thus we speak of thick beds of limestone separated by "wayboards" of slaty shale, of sandstones separated by "wayboards" of clay—these thin layers indicating the lines of junction at which the strata separate or give way.

Weald (Sax. *wold*, a woodland).—The low country lying between the North and South Downs of Kent and Sussex; and from this locality being the chief area in Britain of a formation that lies between the Oolite and the Chalk, the term *Wealden* or *Weald* has been applied to the strata of that formation.—See **WEALDEN GROUP**.

Wealden Group.—In the tabulations of English geologists, that series of strata which occurs between the uppermost beds of the Oolite and the lower ones of the Chalk formation. By some it is regarded as a fresh-water or estuarine group of the Oolitic system; by others it is classed as the lowest member of the Cretaceous system; but as a subordinate "group," lithologically and palæontologically, it is sufficiently distinct from either. Dr Mantell, to whom we are indebted for the most detailed account of the

Wealden, describes it as "a series of clays and sands with subordinate beds of limestone and shale, containing fresh-water shells, terrestrial plants, and the teeth and bones of reptiles and fishes; univalve shells prevailing in the upper, bivalves in the lower, and saurian remains in the intermediate beds; the state in which the organic remains occur manifesting that they have been subject to the action of river-currents, but not to attrition from the waves of the ocean." As a group, the Wealden is of limited extent in England and on the continent of Europe, while in other regions its precise equivalents have not yet been detected. As typically developed in Kent and Sussex, it seems to occupy the site of an ancient estuary, which received the clay and mud of some gigantic river, whose waters occasionally bore down the spoils of land plants and land animals, to be entombed along with those of aquatic origin. Regarding it as the upper group of the Oolitic system, it may be said to consist of two main members—the Weald Clay and Hastings Sands, which, when analysed, exhibit the following particulars, taken in descending order:—

Weald Clay.—Thick blue clays, having in the upper part septaria of argillaceous ironstone, and in the lower parts beds of the shelly fresh-water limestone (*paludina limestone*) known as "Sussex, Petworth, or Bethersden marble."

Hastings Sands.—Fawn-coloured sand and friable sandstone (Horsham beds); calciferous sandstones, alternating with friable and conglomerate grits (Tilgate beds); white sand and friable sandstone alternating with clay (Worth Sandstone); bluish limestone alternating with blue clay and sandstone shale, and some beds of calciferous sandstone (Ashburnham beds).—See tabulations, "GEOLOGICAL SCHEME."

Weathering.—The wasting or wearing away of rock-surfaces by exposure to the atmosphere or weather. Geologists speak of the "fresh fracture" in contradistinction to the "weathered surface," which is often merely discoloured or covered by a pellicle of lichens.

Weather-worn.—Applied to rocks and cliffs whose faces are less or more wasted and worn away by the action of the water. Many rocks being of unequal hardness, their weather-worn surfaces present very fantastic shapes, and are often deeply pitted and honeycombed.

Websterite (after Dr Webster).—Hydrous subsulphate of alumina; known also as *Aluminite*; a snow-white or yellowish-white earthy mineral occurring in soft reniform masses, with a very fine scaly or fibrous structure. It seems to arise from the decomposition of clays in recent formations, and consists of 30.26 alumina, 23.37 sulphuric acid, and 46.37 water.

Wenlock Limestone and Shale.—A characteristic group or section of the Upper Silurian strata, typically developed near Wenlock, in Shropshire. Near Wenlock the *limestone* (formerly well known to collectors as the "Dudley Limestone") consists of thick masses of grey sub-crystalline strata, replete with corals and encrinites. It is essentially of a concretionary nature, the concretions being locally known as "bell-stones," and consisting of pure carbonate of lime. The *shale*, which is a mass of fine argillaceous matter, imbedding numerous calcareous concretions, is by far the largest member of the group, ranging from 600 to 1000 feet in thickness, and replete with corals, encrinites, trilobites, shells, and other marine exuvies. Near Coalbrookdale the shale is known as "die-earth," because it lies beneath all the mining ground—the minerals "dying out," as it were, at this stage of descent.—See SILURIAN SYSTEM.

Wernerite (after Werner).—A rare mineral, occurring in long prismatic crystals, translucent, colourless, pale-grey or greenish-yellow; and found chiefly in veins in the crystalline rocks. Chemical and crystallographic constitution somewhat uncertain, but now regarded as a variety of *SOAPO-LITE*, which see.

Wetherella (after Mr Wetherell).—One of Mr Bowerbank's genera of fossil fruits from the London Clay. They seem to have been pulpy fruits divided into two lobes by the expansion of the ripe seeds; and from the appearance which their section presents, are popularly known as "petrified coffee-berries."

Wheal.—In Cornwall a very frequent designation for a mine; being a modern form of the old Cornish word *Huel*, a mine.

Whet-stone.—Known also as "Whet-slate" and "Novaculite;" a very hard, fine-grained siliceous slate, used for sharpening knives, joiners' tools, and other instruments.—See *HONE*.

Whim.—In mining, a machine consisting of a winding barrel or cylinder, usually worked by horse or water power, and used for raising ore, coal, or other stuff from a mine.

Whin, Whinstone.—Used in Scotland as synonymous with greenstone; but applied by miners and quarrymen to any hard resisting rock that comes in the way of their operations.

Whirl or Whorl.—In conchology, a wreath or single turn of the spire of a univalve shell, such as the *helix* or garden snail. The axis of revolution is termed the *columella*, and the turns of the spiral are denominated *whirls* or *whorls*. In some shells the whirls are few, in others they are numerous and distinct; in some they are arranged in a long, tapering, screw-like spiral; in others they form a short, pointed cone; while in many they are coiled round each other on a horizontal plane in wheel-like or discoid form. In most univalves, when the aperture is turned towards the spectator, and the apex upwards, the whirls run from left to right to the apex; in a few this order is reversed; hence we speak of *reversed* or *sinistral* shells.

Whirlpool.—Any rotatory or circular motion of water produced by opposing winds and tides. The whirlpool of Maelström, on the coast of Norway, is occasioned by the meeting of tidal currents round the islands of Lofoden and Moskoe. It is a mile and a half in diameter, and so violent that its roar is heard at the distance of several leagues.

Whirlwind.—The name given to aerial currents that assume a rotatory, whirling, or spiral motion. They are often of great violence, but fortunately of short duration, and are most frequently caused by the meeting of two contrary winds, though sometimes by obstructions of the land, as precipitous mountains, narrow gorges, and the like. Their occurrence at sea produces *waterspouts*; on the loose sands of the desert, *sand-pillars* and kindred phenomena.

Whitby Snakes.—A provincial, and now obsolete, term for the coiled-up snake-like shells of the ammonite, found abundantly in the Lias of Whitby, in Yorkshire.

Whitstone.—A variety of felspathic granite; the *Weiss-stein* of Werner; and the *Eurite* of French mineralogists.—See *EURITE*.

Wichtianite or Wichtyna.—One of the Garnet family, nearly allied to *Glaucophane* (which see); and so called from its being found at Wichtis in Finland.

Williamite (after Prof. Williams).—A siliceous oxide of zinc, nearly

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related to *Galmei* or electric *calamine*, and usually found along with it.—See ZINC.

Wind (Sax.).—The general name for aerial currents caused by the unequal heating of the atmosphere—the heated and more rarefied portions ascending, and the colder and denser flowing downwards to supply their place. Winds are divisible into three great categories—*permanent*, like the trade-winds; *periodical*, like the monsoons and the sea and land breezes; and *accidental*, when the times of their occurrence cannot be determined.

Windward.—In nautical phraseology, all objects on the weather-side of a vessel, or that against which the wind blows, are said to be to the *windward*—that is, in the direction *from* which the wind blows.—See LEEWARD.

Win, Winning.—In mining phraseology, the term “winning” is applied to the whole series of operations—boring, sinking, excavating, &c.—by which any mineral is actually procured or “won” from the crust of the earth. Most frequently used in coal-working.

Wings.—In mining phraseology, the sides or slopes of an anticline or saddle-back.

Wissenbach Slates.—A series of slaty schists, impure limestones, and quartzose beds, which lie at the base of the Devonian system as developed in the country along the Rhine.

Withamite (after Dr Witham).—A variety of epidote, found in porphyry in Glencoe, and occurring in minute bright-red crystals.—See EPIDOTE.

Witherite (in honour of Dr Withering, its discoverer).—Carbonate of barytes (80 barytes, 20 carbonic acid); known also as *barolite*, and found abundantly in veins traversing the older formations. It occurs massive of a somewhat fibrous structure, or in distinct crystals; whitish or yellowish grey, and strongly translucent.—See BARYTES.

Wöhlerite (in honour of Wöhler the chemist).—A translucent, vitreous, yellowish-brown mineral, occurring in tabular crystals, or in strongly striated six- or eight-sided prisms in the zircon-syenite, near Fredericksværn and Brevig in Norway; and containing, according to Scheerer, 30.62 silica, 14.47 niobic acid, 15.17 zirconia, 26.19 lime, 7.78 soda, and the protoxides of iron and manganese.

Wolchite.—The *prismatic copper-glance* of Phillips; a mixed ore of copper, lead, antimony, arsenic, and sulphur, occurring in the iron mines of Wölch, in Carinthia.

Wolchonskoite, Wolchonskoite.—A variety of chrome-ochre, occurring as an emerald-green or blackish-green massive mineral, and containing from 20 to 35 per cent of chrome-oxide.

Wolfram (Ger. *wolf*, wolf, and *rahm*, froth).—The name given by Werner to the tungstate of iron and manganese, a mineral occurring in short prismatic crystals, or in granular froth-like aggregates of a blackish-brown colour, metallic adamantine lustre, and having a specific gravity of from 7 to 7.5, and a hardness about 6. It occurs, for the most part, associated with ores of tin in the primary and transition rocks, and occasionally in such abundance as to render the tin-ore worthless. According to Berzelius, it consists of 74.67 tungstic acid, 18 protoxide of iron, and 6 manganese, with a trace of silica.

Wolfsbergite.—Antimonial copper; a double sulphuret of copper and antimony, found crystallised, massive, or granular, in quartz at Wolfsberg, in the Harz Mountains.

Wollastonite (after Wollaston the chemist).—The *tabular spar* of Phillips;

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a silicate of lime, with traces of magnesia and iron, occurring chiefly in granular limestone, but also in the trap and volcanic rocks. It is ranked as one of the Hornblende family, but is rarely crystallised—occurring mostly in broad prismatic or tabular masses, of a greyish-yellow or reddish-brown colour, having a vitreous or pearly lustre. Specific gravity, 2.8; hardness, 4.5.

Wood-Coal.—A synonyme for *Lignite* or *Brown-coal*, in allusion to its woody texture, which is often as distinct and well-preserved as the texture of recent timber.—See **LIGNITE**.

Wood-Opal.—A variety of opal, known also as *lithoxylon* or opalised wood, in which the form and texture of the wood is still distinctly visible. Beautiful specimens are obtained from Hungary, and from near Hobart Town in Van Diemen's Land.

Woodstone.—A familiar term for silicified wood, such as that from Antigua, the Desert of Cairo, and Van Diemen's Land.

Wood-Tin.—Fibrous oxide of tin; a variety of tin-ore so called from its fibrous texture resembling that of wood. It is usually of a brown or yellowish-grey colour, and occurs in rounded fragments, having an internal fibro-radiating texture. It is found in Cornwall, Mexico, and other tin-yielding countries; and consists, according to Vauquelin, of 91 oxide of tin, and 9 peroxide of iron.—See **TIN**.

Woolwich Beds.—A name occasionally employed by English geologists to designate those beds of plastic and mottled clays, sands, and rolled flint-pebbles which lie between the "Thanet Sands" and the "London Clay." Next to the Thanet Sands they form the lowest beds of the London Tertiary Basin.

Wrae Limestone.—A limestone of the Lower Silurian series, occurring at Wrae Hill, near Innerleithen, in Peeblesshire.

Wulfenite.—A mineralogical term for the molybdate of lead; a mineral of a wax or orange-yellow, occurring in short prismatic or pyramidal crystals collected in druses, and found in beds and veins in Secondary and transition limestones. Consists of 60 protoxide of lead, and 40 molybdic acid.

Wych or Wich.—A Celtic word signifying *salt spring*; hence the termination of such English towns as Droitwich, Nantwich, Middlewich, &c., where salt springs exist.

X

Xanthidium (Gr. *xanthos*, yellow).—A genus of Diatoms, whose microscopic case or fristule consists of a hollow, siliceous globe, beset with spines; and whose endochrome or colouring matter, in recent species, is of a deep yellowish-green; whence the name. They abound in recent, Tertiary, and upper Secondary formations; and from their increase by self-division, usually appear as twin spherules.

Xanthite (Gr. *xanthos*, yellow).—A mineral of the Garnet family, occurring in small, greenish-yellow, translucent, loosely-connected grains, in a bed of limestone near Amity in New York. It seems, from its composition, to be a variety of *idocrase*, which is found in the same locality.

Xanthokon.—A sulpho-arsenite of silver, occurring in rhombohedric crystals, or in small reniform masses; and so called from its orange-yellow or yellowish-brown colour. It consists of 63.4 silver, 14.7 arsenic, and 21.9 sulphur.

Xanthophyllite (Gr. *xanthos*, yellow; *phyllon*, leaf; and *lithos*).—The rhombohedric pearl-mica of Mohs, occurring in mica and talc schists, and so named from its yellowish colour and foliated texture.

Xiphosura (Gr. *xiphos*, a sword, and *oura*, a tail).—Literally “sword-tail;” a division of the entomostracous crustaceans, in which the last segment of the body forms (in the adult animal) a long, three-edged, sharp-pointed weapon, as in the limulus, or king-crab. The *xiphosura* differ from other crustaceans in having the basal joint of their thoracic feet furnished with spines which serve as masticatory organs (foot-jaws); in having their branchiæ or gills composed of membranous folds attached to the basal portion of the abdominal legs; in having the head and breast united into one buckler-like plate (the cephalo-thorax); and in having the abdominal buckler terminating in the long sharp-pointed spine which gives them their name. The thoracic feet, which generally terminate in pincer-like claws, are used for prehension and mastication; the abdominal, which are foliaceous or leaf-like, subserve the purposes of swimming and respiration. The existing species are all marine, and inhabitants of warmer regions; the fossil species range from the Upper Silurian and Lower Old Red, and appear to have been of much more gigantic dimensions than their living congeners.

Xylite (Gr. *xylon*, wood).—A mineralogical term for those varieties of amianthus which have a woody-like texture; and better known, perhaps, as “mountain-wood,” “rock-wood,” &c. They consist essentially of silica, magnesia, and iron protoxide.

Xylóbius (Gr. *xylon* and *bios*).—Literally “timber-liver;” a small chilognathous myriapod discovered by Dr Dawson in the interior of sigillarie in the Lower Coal-measures of Nova Scotia; and so termed from its supposed habit of burrowing in the decayed trunks of trees, such as those in which its remains were found petrified. If indeed a myriapod, it is the earliest of its kind yet known to palæontology.

Xylóretine (Gr. *xylon*, wood, and *retine*, resin).—Literally “wood-resin;” a sub-fossil resinous substance occurring in connection with the pine-trunks of certain peat-mosses, and evidently the slightly-altered resins of these trees.

Y

Yácolite.—The name given by Lametheric to the *Thummerstein* of Werner, and the *Azinite* of Haiiy. One of the Garnet family, consisting of silica, alumina, lime, iron, and manganese.

Yellow Earth, Yellow Ochre.—A massive earthy mineral of the Clay family, of an ochre-yellow colour, somewhat greasy feel, adheres to the tongue, and pulverises in water. It seems to be a mixture of hydrous

silicate of alumina, with hydrous peroxide of iron ; and is perhaps a decomposed clay-ironstone. When burnt and prepared it is sold by the Dutch as a pigment under the name of "English Red."

Yénite.—A double silicate of lime and iron, occurring in crystalline strata, along with quartz, magnetic ironstone, copper pyrites, and other ores ; and known also as *Lievrite* or *Ilvaité*. It was named *Yénite* in commemoration of the battle of Jena, in 1806 ; *Ilvaité*, from Elba, where it occurs ; and *Lievrite*, after its discoverer, Le Lievre.

Yoredale Rocks.—The name given by English geologists to the upper group of the Carboniferous Limestone, as developed in the north-western parts of Yorkshire—the *Scar Limestone* forming the lower group. The Yoredale Rocks consist of several beds of limestone alternating with freestones, flagstones, shales, and thin seams of coal, and attain a thickness of about 1000 feet.

You-Stone.—A familiar term for Chinese *Jade*, or *Nephrite*, which see.

Yttria.—The name given by Ekeberg to a new earth discovered by Gadolin, in 1794, in the quarry of Ytterby in Sweden ; hence the name. It has also been called *Gadolinite* (which see), after its original discoverer.

Yttria-Spar.—According to Hartmann, this occurs as a white incrustation, as Gadolinite, and other minerals from Ytterby in Sweden.

Yttrium.—The metallic basis of the earth *yttria*. When separated from the silica, lime, iron, and manganese with which it is associated in yttria, it appears as a fine white powder, tasteless, inodorous, infusible, and insoluble in water.

Yttrio-Cérite.—A rather rare mineral substance, occurring in granular incrustations of a violet-blue to a whitish-grey colour ; and consisting, according to Berzelius, of about 47 lime, 18 peroxide of cerium, 10 yttria, and 25 hydro-fluoric acid.

Yttrio-Columbite.—The name given by Brochant and Dana to yttrious oxide of columbium ; *Yttrio-tantalite*, which see.

Yttrio-Ilmenite.—Same as *Lamarckite*, which see.

Yttrio-Tantalite.—Yttrious oxide of tantalum ; a mineral occurring in kidney-shaped masses, of a shining metallic lustre, at Ytterby in Sweden. Berzelius distinguishes the black, brown, and yellow varieties ; which consist of somewhat varying proportions of tantalic and tungstic acids, yttria, lime, and peroxides of uranium and iron.

Yttrio-Titanite.—Known also as *Keilhauite* ; a blackish-brown translucent mineral, having a resinous fracture, and much resembling garnet, but distinguished by its greater specific gravity. It is a silicate of lime, iron, and alumina, with titanio acid and yttria ; and occurs in the granitic and crystalline rocks of Norway.

Z

Zaffre.—In mineralogy, the impure oxide of cobalt, being the residuum of the native arseniuret of cobalt, after the arsenic, sulphur, and other volatile matters have been expelled by calcination. Melted with silica and potash, and reduced to powder, it becomes the "powder-blue" of commerce.

Zamiostrobus.—The generic term applied to fossil cone-like fruits, apparently those of plants allied to the zamia and cycas. They occur chiefly in the Upper Oolite, Wealden, and Chalk formations.

Zamites.—The general term for all fossil plants apparently allied to the existing zamia. They make their appearance in the Upper Oolites, and continue throughout the Secondary and Tertiary formations. The existing zamias (see order *Cycadaceæ*) being natives of the tropical parts of Asia and America, and of the Cape of Good Hope and Australia, their occurrence in ancient formations gives evidence of tropical or sub-tropical conditions of climate in the areas of deposit.

Zégonite (Gr. *zeo*, I swell or bubble up, and *gone*, an angle).—A mineral of the Zeolite family, and so named from its tetragonal crystals, which are chiefly arranged in spheres or bundles. Known also as *Gismondine* and *Abrasilite*; but not very decidedly separable from the lime or potash *harmotomes* or cross-stones, to which it is often referred.

Zechstein (Ger.).—Literally "mine-stone;" because it has to be mined or cut through to reach the copper-slate (*Kupfer-schiefer*) which lies immediately beneath it. Von Buch suggests that the word was probably derived from the Italian *zecchino* or sequin, formerly a well-known coin in Germany, because this calcareous rock was the cover which, being pierced, led to the bed of ore from which the miner derived his profit. The German "Zechstein"—upper and lower—is the equivalent of the Permian or Magnesian Limestone of England.—See PERMIAN SYSTEM.

Zellania.—A sub-genus of Terebratulæ occurring in the Oolitic formation, and characterised by their small, triangular, distinctly punctate shells, which are rounded in front, taper towards the beak, are thickest at the umbo, and have the sides somewhat flattened.

Zenith (Arabic).—In astronomy, that point in the heavens which is vertically or right above the head of the spectator; the term *nadir* being that which denotes the opposite point, or that perpendicularly or right under his feet. In popular language, the term *Zenith* is used to denote the highest or culminating point of any subject referred to; as the "zenith of the poet's fame," the "zenith of saurian development."

Zeolite (Gr. *zeo*, I boil or bubble up, and *lithos*, stone).—An extensive family of minerals—silicates of lime and alumina—so called from their frothing or intumescing into a whitish spongy enamel under the blowpipe. The family includes hexahedral zeolite or *analcime*, prismatic or *natrolite* and *mesotype*, prismatoidal or *stilbite*, hemiprismatic or *Heulandite*, pyramidal or *apophyllite*, rhomboidal or *chabasite*, diprismatic or *laumontite*, paratamous or *harmatome*, &c., all of which are noticed under their respective names. The zeolites occur most abundantly in the amygdaloidal trap-rocks; frequently in basalt and greenstone; occasionally in the granitic and crystalline rocks; and more rarely in the trachytes and lavas.

Zéro.—A word of Arabic origin signifying emptiness or extreme deprivation, and usually represented by a cipher or 0. It is variously used in science; but may be generally defined as the neutral point between any ascending and descending scale or series. In familiar language it is used as synonymous with nothing, or the extreme point of depression. The zero of Fahrenheit's thermometric scale is 32° below freezing; the real or absolute zero would be the point at which caloric was entirely exhausted.

Zeuglodon (Gr. *zeugos*, a yoke, and *odous*, tooth).—Literally "yoke-tooth;" a Tertiary mammal of the whale kind, so called by Professor Owen

from the peculiar form of its molar teeth. Remains of a skeleton between seventy and eighty feet in length were first discovered in the Eocene strata of Alabama and Arkansas, and described by Dr Harlan under the title *BASILOSAURUS* (*king of the lizards*), under the supposition that they belonged to an enormous reptile—a belief that has since been set aside by the more correct investigations of our great English anatomist.

Zéuxite (Gr. *zeuxis*, connection or union, because found in the *united mines*, Cornwall).—A mineral of the Scapolite family, occurring in fibrous masses of acicular crystals of a greenish-brown colour, and evidently allied to *Prehnite*. Chemically, it is a ferro-silicate of alumina.

Zianite.—Werner's synonyme for kyanite or cyanite, one of the Garnet family, which see.

Zinc (Ger. *zink*).—One of the simple or elementary bodies; a metal of a bluish-white colour, with a fine granular fracture, foliated structure, specific gravity about 7, harder than lead, but may easily be cut with a knife. At common temperatures it is tough and intractable under the hammer; but when heated to between 220° and 320° it becomes malleable and ductile, so that it can be beaten into plates, or rolled into sheets and leaves, and drawn into wire. If heated, however, to 500° or so, it becomes brittle, and fuses at 770°. It tarnishes on exposure to the air, but is little oxidated, the first-formed film of oxide long resisting the action of air and water, and thus preventing further decay. Being a cheap and light metal, zinc is largely used as a substitute for lead; alloyed with copper, it forms the well-known compound *brass*; and its salts are extensively used in medicine and the arts. As a metal, zinc does not occur native; and its chief ores are—*calamine*, or the carbonate, occurring most abundantly in limestones along with calc-spar, ores of lead and iron, and other ores of zinc; *blende*, or the sulphuret, found also in veins with other ores; *Goslarite*, or the sulphate, arising apparently from the decomposition of blende; *zincite*, or the red oxide; and *galmei* or the siliceous oxide, usually found in connection with calamine. The ores of zinc are readily determined by first roasting and then fusing by the blowpipe on charcoal with copper filings. If zinc is present the copper will be converted into a button of brass.

Zincite.—The mineralogical term for the native ferriferous oxide of *zinc*, which see.

Zinckenite, properly *Zinkenite*.—A native sulphuret of antimony and lead (35 lead, 43.4 antimony, and 21.6 sulphur), occurring in narrow vertically-striated prisms, or in massive and columnar aggregates in veins, along with sulphuret of antimony and quartz, at Wolfsberg, &c., in the Harz, and so named after its discoverer, Zinken.

Zircon.—One of the gems; a heavy, hard, sparkling mineral, more or less transparent; doubly refractive; and occurring colourless, or of various colours, as yellow, green, and reddish-brown. It is found in prismatic crystals, or in rounded grains, chiefly in the granitic and crystalline rocks; and consists, according to Berzelius, of 33 silica and 67 zirconia. The colourless varieties named *jargon* are often sold for diamonds; the brilliantly-coloured are termed *hyacinth*, though many "hyacinths" are merely garnets, and easily detected by their inferior gravity, hardness, fusibility, and want of double refraction.

Zircónia.—The oxide of zirconium; a white tasteless earth, discovered by Klaproth in 1789, in zircons from Ceylon—zircon being a silicate of zirconia more or less highly coloured by oxide of iron.

Zircónium.—The metallic basis of zirconia, obtained in the form of a black powder, resembling that of charcoal, but lustrous when rubbed.

Zoanthária (Gr. *zoon*, animal, and *anthos*, flower).—Animal-flowers; in De Blainville's arrangement, the third class of zoophytes, including the hydras, coral-polypes, sea-anemones, and the like, whose bodies or digestive sacs are furnished with tentacula, which radiate from the mouth like the petals of a flower.

Zodiac (*zodion*, a little animal).—The name given by astronomers to the zone within which the apparent motions of the sun, moon, and all the greater planets are performed. It constitutes a belt nine degrees on either side of the ecliptic, and is so named from its containing the figures of the animals, &c., which represent the twelve signs.

Zoisite.—A variety or sub-species of epidote, or prismatoidal augite spar, of a yellowish or light-grey colour, occurring in granite, diorite, and other crystalline rocks, and named after its discoverer, Baron von Zois.

Zone, in geography (Gr. *zona*, a girdle).—One of the five great belts into which the earth is supposed to be divided in respect to temperature; viz., the *torrid*, two *temperate*, and two *frigid* zones. The torrid includes all the space that lies between the tropics, or $23\frac{1}{2}$ degrees on each side of the equinoctial line; the temperate from that limit to the arctic circle ($66\frac{1}{2}$ degrees) in each hemisphere; and the frigid zones from the arctic circles to either pole.

Zone, in botany.—With a view to generalise their observations on the geographical distribution of indigenous plants, botanists are in the habit of dividing the horizontal range of vegetation into *zones*, bounded by annual isothermal lines, as—1, the equatorial; 2, tropical; 3, sub-tropical; 4, warmer temperate; 5, cooler temperate; 6, sub-arctic; 7, arctic; and, 8, the polar. These zones, being applicable to either hemisphere, express the climatic facies of vegetation within more precise limits than the three great zones—torrid, temperate, and frigid—of the geographer.

Zone, in zoology.—Every zone, from the shore daily covered by the tides to the greatest vital depths, being characterised by its own peculiar sea-weeds and shell-fish, in a manner very analogous to the changes in the forms and species of vegetation observed in the ascent of a tropical mountain, zoologists are in the habit of speaking of certain bathymetrical zones or "zones of life regulated by depth." Thus, in the British seas, naturalists (following the late Edward Forbes) point out four great belts of life—the *Littoral*, the *Laminarian*, the *Coralline*, and the *Coral* (which see); or, applying the principle to the life of the ocean in general, they distinguish five belts of depth—viz., 1, the Littoral; 2, Circum-littoral; 3, Median; 4, Infra-median; and, 5, the Abyssal or Deep-sea zone. "The life-forms of these zones," says Professor Owen, "vary, of course, according to the nature of the sea-bottom; and are modified by those primitive or creative laws that have caused representative species in distant localities under like physical conditions—species related by analogy. Very much (he continues) remains to be observed and studied by naturalists in different parts of the globe, under the guidance of the generalisations thus sketched out, to the completion of a perfect theory; but in the progress to this the results cannot fail to be practically most useful. A shell or a sea-weed, whose relations to depth are thus understood, may afford important information or warning to the navigator. To the geologist, the distribution of marine life according to the zones of depth has given the

clue to the determination of the depth of the seas in which certain formations have been deposited."

Zoölogy (Gr. *zoon*, an animal, and *logos*, discourse).—The science of living beings in all that relates to their structure, habits, distribution, and classification. *Zoological*, appertaining to the science of animal life; *zoologist*, one devoted to the study of zoology, or the knowledge of animal forms in all their relations—structural, functional, and gradational. For systematic arrangements, see tabulations, "ANIMAL SCHEME."

Zoönomy (Gr. *zoon*, an animal, and *nomos*, law).—The science which treats of the laws of organic life, in as far as these relate to the *Animal* kingdom.

Zoöphagous (Gr. *zoon*, an animal, and *phago*, I eat).—Animal-eating; applied to certain tribes of animals (e. g., "zoöphagous molluscs") which prey on other animals: in contradistinction to those that are *phytophagous* or vegetable-feeders.

Zoöphyte (Gr. *zoon*, animal, and *phyton*, plant).—Animal-plants; an early and popular division of the animal kingdom, including the sponges, corals, and other allied aquatic creatures, which, from their manner of growth and appearance, were supposed to be intermediate between plants and animals. Being wanting in scientific precision, the term is only loosely and popularly applied to those polypes, polyzoa, &c., which secrete plant-like substances, as sponges, corals, corallines, and so forth.

Zoophytology (Gr. *zoophyton*, a zoöphyte, and *logos*, discourse).—That department of natural history which treats of the structure, mode of growth, habits, and distribution of zoöphytes.

Zosterites.—A genus of fluviatile plants occurring in the Wealden and Lower Greensand formations, and so called from their resemblance to the existing *zostera marina* or sea-wrack. In *zosterites* the leaves are linear, marked with few veins, and these not connected by transverse veins.

Zündererz (Ger.).—Tinder-ore; an ore of antimony occurring in the Saxon mines in soft, flexible, tinder-like masses, of a blackish-red colour and little lustre. From analysis it appears to be an admixture of silver, lead, iron, antimony, arsenic, and sulphur.

Zwieselite.—A fluo-phosphate of iron and manganese, so called from being found at Zwiesel, in Bavaria.

Zygomatúrus.—A large marsupial mammal—the most extraordinary yet discovered in the Post-tertiary deposits of Australia, and so named from the great width of the zygomatotic arches of the skull. Judging from the size of the head, which was the only portion found in 1868, it seems to have been as large as an ox, and to have had a face somewhat resembling that of the existing wombat. It also appears to make a near approach to, though differing generically from, the *Diprotodon*, another large marsupial from the same ancient alluvial beds.

III

SPECIFIC APPELLATIONS

NOTE.

THE following List contains the greater portion of those terms employed by palaeontologists to distinguish their so-called *species* of fossil plants and animals.* Most of them are Latin, or Latinised forms, and refer chiefly to external aspect; not unfrequently to the name of the discoverer, or other individual eminent in the branch of natural history to which the object belongs; and in many instances to the locality where it was first detected, or in which it is exclusively found. Thus, *Pecten quinquecostatus*, the five-ribbed pecten; *P. Woodwardii*, after S. P. Woodward, the eminent conchologist; and *P. Purbeckensis*, a species apparently peculiar to the Purbeck beds of the Oolite. Whatever their origin (and it is greatly to be desired that describers would in every instance endeavour to adopt such terms as refer to some palpable characteristic), these designations follow the usual inflexion of Latin words; *rotundus*, *rotunda*, *rotundum*—*pulcher*, *pulchra*, *pulchrum*—or *brevis*, *brevis*, *breve*, being respectively applied just as the generic word to which they refer may be masculine, feminine, or neuter; while the names of discoverers, &c., are thrown into the possessive case, as *Lyellii*, *Murchisoni*; and those of localities converted into adjectives, as *Hibernicus*, *Purbeckensis*, and the like, but this, it must be confessed, not always in the most classical or most euphonious forms. Our present business, however, is more with their meanings than with their origin, and these we have endeavoured to render in the simplest and briefest language, consistent with the comprehension of the fact or character which the original term was intended to express.

* We say "so-called *species*," for, in the emphatic words of Professor Carpenter, "there are still too many who are far too ready to establish new species, upon variations of the most trivial character, without taking the pains to establish the value of these differences, by ascertaining their constancy through an extensive series of individuals,—thus, as was well said by the late Prince of Canino, 'describing specimens instead of species,' and burdening science not only with a useless nomenclature, but with a mass of false assertions. It should be borne in mind that every one who thus makes a bad species, is really doing a serious detriment to science; whilst every one who proves the identity of species previously accounted distinct, is contributing towards its simplification, and is therefore one of its truest benefactors."

SPECIFIC APPELLATIONS.

A

- A'elensis*, *is, e*; found at Aalen in Wirtemberg.
- abbreviatus*, *a, um*; shortened; comparatively short.
- abductus*, *a, um*; removed.
- abies*; the fir-tree; fir-tree-like.
- abjectus*, *a, um*; worthless.
- abnormis*, *is, e*; out of the usual order; abnormal.
- abruptus*, *a, um*; abrupt; terminating suddenly.
- Acadianus*, *a, um*; of, or belonging to, Nova Scotia.
- acaulis*, *is, e*; stalkless; stemless.
- accipenseroides*; sturgeon-like; resembling the sturgeon.
- acerbus*, *a, um*; of the maple-tree; resembling the maple.
- acetabulum*; slightly concave, like a cup or calyx.
- aciculatus*, *a, um*; needle-pointed; furnished with sharp points.
- acidentatus*, *a, um*; needle-toothed; sharp-toothed.
- acinaciformis*, *is, e*; scimitar-shaped.
- actinura*; star-tailed; prickly-tailed.
- aculeatus*, *a, um*; prickly; armed with sharp points.
- acuminatus*, *a, um*; pointed; terminating sharply.
- acutangulus*, *a, um*; acute-angled; sharp-cornered.
- acutifolius*, *a, um*; sharp-leaved; having pointed leaves.
- acutirostris*, *is, e*; sharp-nosed; sharp-beaked.
- acutiusculus*, *a, um*; rather sharp; somewhat acute.
- adelphinus*, *a, um*; brotherly; in brotherhoods; closely related.
- aduncatus*, *a, um*; hooked; formed like a hook.
- aduncus*, *a, um*; crooked; shaped like a hook or claw.
- agagræpiloides*; shaggy; like the wild goat's hair.
- æquilatæris*, *is, e*; equal-sided; having equal sides.
- æquiseptatus*, *a, um*; equally divided by septa or partitions.
- æquiluloides*, *a, um*; equal-furrowed; having furrows of equal size.
- æquivalvis*, *is, e*; equal-valved; valves of the same size.
- affinis*, *is, e*; adjoining; contiguous.
- agariciformis*, *is, e*; shaped like a mushroom.
- agaricoïdes*; mushroom-like.
- Agassizi*; in honour of Agassiz, the distinguished naturalist.
- agglutinans*; glued to, or joined to one another.
- agræstis*, *is, e*; belonging to the fields; field-dwelling.

alatus, a, um; winged; having wing-like appendages.
albo-gálterus; white-hat; white-helmet shape.
aliformis, is, e; wing-shaped; in the form of wings.
Allani; after Mr Allan, of Edinburgh, mineralogist.
Alnwickensis, is, e; found at Alnwick in Northumberland.
alpētris, is, e; alpine; growing at great elevations.
alitrans; alternating; following one after another.
alternātus, a, um; alternating; following at intervals.
alutāceus, a, um; tanned; like tanned leather.
alveolāris, is, e; hollowed like a trough or channel.
ambiguus, a, um; ambiguous; doubtful.
ammonoides; ammonite-like; curved like a ram's horn.
amphibius, a, um; amphibious; living on land or in water.
amphōra; a flaggon; flaggon-shaped.
ampliātus, a, um; enlarged; spread out.
amplus, a, um; full; full-sized.
ampālla; a flask or flagon; flask-shaped.
ampullāceus, a, um; bottle-shaped; flagon-like.
ampullōsus, a, um; puffed out; flagon-like.
amygdalæformis, is, e; almond-shaped.
amygdaloides; almond-like; in the form of almonds.
anastomosans; veined; running one into another like the veins of a leaf.
anastomōsus, a, um; anastomosing; running one into another like the veins of a leaf.
ānātinus, a, um; duck-like.
āncēps; doubtful; undetermined.
ancylōides; shield-like; formed like a shield.
Andersoni; after the Rev. Dr Anderson of Newburgh, Fife.
angeioides; vessel-like; flagon-shaped.
Anglicus, a, um; English; found in England.
anguilla; an eel; eel-like in form.
angustātus, a, um; narrowed; constricted.
angustidens; narrow-toothed; compressed tooth.
angustifolius, a, um; narrow-leaved.
angustifrons; narrow-fronted; having a narrow forehead.
annēctens; connecting; approaching; akin to.
Anningiæ; after Miss Anning of Lewes, collector of fossils.
annulātus, a, um; annular; ring-shaped; ringed.
anōmalus, a, um; anomalous; irregular.
anomolopōra; having unusual pores.
anthracophilus, a, um; coal-loving; found chiefly in the Coal-measures.
anserinus, a, um; goose-like; of or pertaining to the goose.
Anstedi; after Professor Ansted of London, geologist.
anthracnus, a, um; coaly; found in or belonging to coal.
antiquior, or, us; more ancient; of earlier date.
antiquus, a, um; ancient; of early date.
aperturātus, a, um; full of apertures; fissured.
apicdlis, is, e; sharp-pointed; tapering to a slender point.
apicicurvātus, a, um; curved at the top or apex.

API — AXI

- apiculátus*, *a, um*; pointletted; slender-pointed.
- approximátus*, *a, um*; approximating; close upon one-another.
- aquila*; an eagle; curved like an eagle's beak.
- aráchnotides*; oobweb-like; cobwebby.
- aráchnotides*, *a, um*; in the form of a cobweb; in slender meshes.
- aráneus*, *a, um*; spider-web-like; lightly netted.
- arborescens*; arborescent; branching like a tree.
- archetypa*; original; the original type.
- archerens*; arch or bow bearing; bow-shaped.
- arcos*; belonging to the arctic regions; northern.
- arcuátrius*, *a, um*; arched; bent like a bow.
- arcuátus*, *a, um*; bent; arched; bow-shaped.
- arculátus*, *a, um*; coffer-like.
- arenátrius*, *a, um*; sandy; belonging to the sand.
- arenicolus*, *a, um*; sand-dwelling; burrowing in the sand.
- areolátus*, *a, um*; areolate; divided into a number of irregular squares or small angular spaces.
- argátus*, *a, um*; clear; decided; pretty.
- armátus*, *a, um*; armed; furnished with defences.
- arthráticus*, *a, um*; jointed; furnished with joints.
- articulátus*, *a, um*; articulated; closely jointed.
- articulósus*, *a, um*; jointed; full of joints.
- arvensis*, *is, e*; field-inhabiting; belonging to the fields.
- asper*, *a, um*; rough; rough-surfaced.
- aspergilliformis*, *is, e*; brush-shaped.
- aspergillus*; a brush for sprinkling holy water; brush-like.
- asprerrimus*, *a, um*; extremely rough; harsh with points.
- asprerulus*, *a, um*; roughish; somewhat rough.
- astacoides*; lobster-like; crayfish-like.
- asteriscus*, *a, um*; star-like; in the form of an asterisk.
- asthenodéirus*, *a, um*; weak-necked; slender-necked.
- astroides*; star-like; rayed like a star.
- astrophorus*, *a, um*; star-bearing; starred.
- auloporoides*; pipe-pore-like; resembling the aulopore coral.
- aulóticon*; pipe-shaped; pipe-like.
- aurántium*; an orange; like an orange.
- aurícula*; an ear; like an ear.
- auriculáris*, *is, e*; ear-shaped.
- auriculátus*, *a, um*; eared; having ear-like appendages.
- auritus*, *a, um*; long-eared; decidedly eared.
- Austeni*; after Mr Godwin Austen, geologist.
- avellána*; filbert; like a filbert.
- aventiformis*, *is, e*; oat-pipe-shaped; like an oaten straw.
- aviculoides*; bird-shaped; in the form of a little bird.
- axinaefórmis*, *is, e*; axe-shaped; axe-like.

B

- baccátus*, *a, um*; berried; furnished with berry-like excrescences.
bacilláris, *is, e*; staff-like; straight like a staff.
bacillum; a staff; staff-like.
baculiformis, *is, e*; staff-like; staff-shaped.
balettus, *a, um*; belted.
Bálticus, *a, um*; from the Baltic shores; belonging to the Baltic Sea.
Bankrii; after Mr Banks of Kington, Ludlow.
barbátus, *a, um*; bearded; having hair-like appendages.
Barrandei; in honour of M. Barrande, geologist and palæontologist.
Bechei; after Sir Henry de la Beche, geologist.
Becklesii; after Mr Beckles, geologist and palæontologist.
bellicinctus, *a, um*; beautifully bound or wound round.
bellistriatus, *a, um*; beautifully striated; covered with fine striae.
bellulus, *a, um*; pretty; neat.
bellus, *a, um*; beautiful; elegant.
Beudantii; after M. Beudant, French geologist.
bicalcardus, *a, um*; two-spurred; armed with two spurs.
bicarínatus, *a, um*; having two keels or ridges.
bicatenatus, *a, um*; marked with two chain-like lines or ridges.
bicordatus, *a, um*; in the form of two hearts; twin-hearted.
bicóróna; double-crowned; twin-crowned.
bicostális, *is, e*; having two ribs, or rib-like processes.
bídens; having two teeth; bidentate.
bidorátus, *a, um*; having a double back.
bifasciátus, *a, um*; doubly banded; two-striped.
bífrons; doubly fronted; two-fronted.
bifurcátus, *a, um*; bifurcated; branching in two; forked.
bilínedus, *a, um*; two-lined; marked with two lines.
bilobus, *a, um*; two-lobed; bilobed.
Binneyi; after Mr E. W. Binney of Manchester, geologist.
binus, *a, um*; double; in pairs; twinned.
bioculátus, *a, um*; double-eyed; twin-eyed.
bipartítus, *a, um*; bipartite; divided into two; two-cleft.
bíplex; double; two-fold.
bipunctátus, *a, um*; doubly punctured.
bispínatus, *a, um*; doubly spined.
bisuffarciánatus, *a, um*; doubly stuffed; swollen.
Blainvillii; after Blainville, the French zoologist.
Blumenbáchi; in honour of Blumenbach, German naturalist.
Bollensis, *is, e*; found at Boll in Wirttemberg.
bóöps; ox-eyed; large or full-eyed.
boreális, *is, e*; boreal; belonging to northern latitudes.
botulifórmis, *is, e*; sausage-shaped.
Bouchardianus, *a, um*; after M. Bouchard, palæontologist.
bovinus, *a, um*; ox-like; allied to the ox family.

BOW — CAN

- Bowerbanki*; after Dr Bowerbank of London, microscopist.
brachycephalus, *a, um*; short-headed.
brachydeus; short-necked.
brachypodipterus, *a, um*; short sub-dorsal finned.
brachydus, *a, um*; short-tailed.
brviceps; short-headed.
brevicollis, *is, e*; short-necked; closely attached.
brevifolium; short-leaf; short-leaved.
brevirostris, *is, e*; short-nosed; short-beaked.
brevis, *is, e*; short.
brevispinus, *a, um*; short-spined.
Briareus, *a, um*; many-armed, like the fabled Briareus.
Bristonii; after Mr Bristow, mineralogist, Geological Survey.
Broderipii; in honour of Mr Broderip, geologist.
Brodiet; after Mr Brodie, author of 'Fossil Insecta.'
Brongniarti; after Brongniart, the French fossil botanist.
Brownii, *Browniana*; after R. Brown, the celebrated botanist.
bucardium; ox-heart; shaped like an ox-heart.
buccinatus, *a, um*; trumpet-like.
buccinoidea; like the shell buccinum.
Bucklandi; after Dr Buckland, geologist.
bullatus, *a, um*; bossed; round like a nail-head; studded with small round knobs.
bulloides; shaped like the shell *bulia*.
bursa; a purse; purse- or pouch-shaped.
byssaceus, *a, um*; having a "byssus," or appendage of fine filaments, like flocks of wool.

C

- caelatus*, *a, um*; carved in relief; sculptured.
caespitosus, *a, um*; turf-like; turfy.
calcaratus, *a, um*; spurred; spur-shaped; furnished with spurs.
calcariformis, *is, e*; spur-shaped; in the form of a spur.
calcicola; sandal; like a sandal or slipper.
calligramma; beautiful writing; beautifully marked with lines.
caloptra; beautiful-pored.
calvus, *a, um*; bald; smoothly bare.
calycularis, *is, e*; cup-like; like the calyx of a flower.
calyculus, *a, um*; like a little cup; calyx-like.
Cambrensis, *is, e*; of or belonging to Wales; occurring in Wales.
campanulatus, *a, um*; bell-shaped.
campylodon; curved or crooked tooth.
canaliculatus, *a, um*; channeled; grooved.
canalisferus, *a, um*; furnished with channels or canals.
cancellaria; latticed; furnished with cross-bars.
cancellatus, *a, um*; latticed; cancellated.
cancriformis, *is, e*; crab-formed; crab-like.

- candidus, a, um*; white.
cannæformis, is, e; cane-shaped; having a cane-like stem.
caneritatus, a, um; railed; staked.
caperatus, a, um; shrivelled; puckered in wrinkles.
capillaceus, a, um; hairy; covered with fine hairs.
capillaris, is, e; hair-like; capillary; in tubes like hairs.
capistratus, a, um; haltered; muzzled.
capitatus, a, um; headed; furnished with small heads.
cápræolus; the roebuck; roebuck-like.
caput-serpēntis; shaped like a serpent's head.
carbonaceus, a, um; carbonaceous; found in the Coal-measures.
carbonarius, a, um; of or belonging to the Coal-measures.
cardioides; cadium- or cockle-like.
carinaria; having a keel or ridge.
carinatus, a, um; keeled; furnished with ridges more or less elevated.
carinella; a little keel or ridge.
cariniferus, a, um; keel-bearing; furnished with a keel or projecting ridge.
carpomorpha; fruit-shaped; in the form of a fruit.
caryophyllus, a, um; clove-like; clove-leaved.
cassinoides; helmet-like.
cassis; a helmet; in the form of a helmet.
castaneus, a, um; chestnut-like.
catenatus, a, um; chained or connected together.
catēnifer, a, um; chain-bearing; linked like a chain.
catenulatus, a, um; chained; formed of little links.
cathedrālis, is, e; spire-like; tapering and spire-like.
catillus; a little dish.
cātus; the cat; cat-like.
cauda-galli; like the tail of a cock; arranged like the plumes in a cock's tail.
caudalis, is, e; tailed; having a prominent tail.
caudatus, a, um; tail-pointed; furnished with a tail.
caulinæfōlia; stalk-leaved.
cavatus, a, um; hollowed out; hollow.
cavifrons; hollow-fronted.
cellularis, is, e; cell-like; cellular; full of cells.
cellulosus, a, um; full of cells; abounding in cells.
centralis, is, e; central; in the middle.
centrochir; goad-hand; goad-fin.
centrotus, a, um; knotted; having prominent tubercles.
cepeformis, is, e; onion-shaped; like an onion.
cervicornis, is, e; shaped like a stag's horn.
cervinus, a, um; deer-like; allied to the deer kind.
chamæformis, is, e; cockle-shaped; like the shell *chama*.
champsoides; crocodile-like; allied to the Nilotic crocodile.
charæformis, is, e; like the fresh-water plant *chara*.
Charlesworthii; after Mr Charlesworth of London, naturalist.
cinctus, a, um; girdled; encircled with lines.
cintreus, a, um; ash-coloured; ashy.

CIN — CON

- cingulātus*, *a, um*; girdled; encircled with lines.
circinātus, *a, um*; compassed; encircled; whorled.
circumstans; surrounding some other object.
circumsulcātus, *a, um*; furrowed all round.
cirrhōsus, *a, um*; cirrhus; terminated by a curled filiform appendage.
cirroides; cirrus-like; having a curled appendage.
citharēlla; little lute.
clathratulus, *a, um*; slightly latticed; slightly cross-barred.
clathrātus, *a, um*; cross-barred; latticed.
clathroidea; bar-like; lattice-like.
clava; a knotty branch; knob-like.
clavaroides; club-like.
clavātula; little club.
clavātus, *a, um*; club-like; club-shaped.
claviculāris, *is, e*; collarbone-shaped; clavicle-like.
claviger, *a, um*; club-bearing.
clisioidea; chamber-like; separated into small chambers.
cluniculāris, *is, e*; haunch-like.
clypeātus, *a, um*; shield-like; furnished with a shield.
cochlearēlla; little screw; spiral-shaped.
cochleātus, *a, um*; screw-shaped; spiral.
Colei; after Lord Cole, now Earl of Enniskillen, palaeontologist.
colubrinus, *a, um*; snake-like.
columbēlla; a little dove.
columellāris, *is, e*; little-pillar-like.
combātus, *a, um*; burnt up; parched; withered-like.
communis, *is, e*; common; of frequent occurrence.
comōsus, *a, um*; bushy; shaggy like hair.
complanātus, *a, um*; smoothed; smooth-surfaced.
complexus, *a, um*; complex; in many folds; not simple.
compressirostris; flattened beak; pressed together.
compressus, *a, um*; flattened; flattened as if by pressure.
comptus, *a, um*; elegant; adorned.
concavus, *a, um*; hollow; depressed; concave.
concentricus, *a, um*; arranged in concentric lines.
conchiticus, *a, um*; shelly; shelly in aspect.
concinus, *a, um*; handsome; pretty; neat.
confluens; confluent; running together; running into one.
conicus, *a, um*; conical; tapering to a point.
conifer, *a, um*; cone-bearing; bearing cones like a fir-tree.
conjūgens; immediately joining; approximating.
conoidens, *a, um*; shaped like a cone; somewhat conical.
conophthalmus; conical eyed; the eye projecting like a cone.
consobrinus, *a, um*; a cousin; nearly allied.
constrictus, *a, um*; bound closely together; constricted.
contiguus, *a, um*; near; close to.
contortidens; twisted tooth; twist-tooth.
contortuplicātus, *a, um*; folded and much twisted.
contortus, *a, um*; twisted.

CON — CRE

- contractus*, *a, um*; contracted; drawn together.
conūlus; a little cone.
convexus, *a, um*; convex; bent round.
convolūtus, *a, um*; convoluted; rolled as it were together.
Conybearii; after the Rev. Dr Conybeare, English geologist.
coralloides; coral-like; having the aspect or structure of coral.
corbūla; a little basket.
cordātus, *a, um*; heart-like; heart-shaped.
cordiformis, *is, e*; heart-shaped.
cornū, *a, um*; horny; having a texture like horn.
corniculātus, *a, um*; horned; furnished with horn-like processes.
cornu; a horn; horn-like in form.
cornu-ariētis; ram's horn; curled like a ram's horn.
Cornūbicus, *a, um*; of, or belonging to, Cornwall.
cornu-būvis; ox-horn; ox-horn-like.
cornu-pastoris; shepherd's horn.
cornūtus, *a, um*; horned; having horn-like appendages.
corollāris, *is, e*; corolla-shaped; blossom-like.
corōna; a crown.
corōnūla; little crown.
corrugātus, *a, um*; corrugated; much wrinkled.
corticātus, *a, um*; having a coat of bark; coated.
corūlum; darling; term of endearment.
corymbōsus, *a, um*; ivy-berried; in clusters.
coryphænoides; diadem-like.
costātus, *a, um*; ribbed; having prominent ridges.
costelātus, *a, um*; having very faint ribs.
costelliferus, *a, um*; marked with little ribs; bearing faint ribs.
costulātus, *a, um*; having little ribs.
Cotteswoldiæ; from the Cotteswold Hills, Gloucestershire.
crassatinus, *a, um*; thickish.
crassicauda; thick tail.
crassicaulis, *is, e*; thick stalked or stemmed.
crassicornus, *a, um*; thick-coned; bluntly-tapering.
crassidens; thick-tooth; thick-toothed.
crassinervus, *a, um*; thick-nerved; fleshy-nerved.
crassirostris, *is, e*; thick-beaked; thick-snouted.
crassispinus, *a, um*; thick-spined; strong-spined.
crassissimus, *a, um*; very thick; the thickest.
crassiūculus, *a, um*; thickish; somewhat thick.
crassiventer; thick-bellied; deep-bellied.
crassosteum; dense-boned; thick-boned.
crassus, *a, um*; thick; stout.
crateriformis, *is, e*; goblet-shaped.
crenato-striātus, *a, um*; convex-striated; marked with convex lines.
crenātula; having small convex teeth.
crenātus, *a, um*; having convex teeth; crenulated.
crenulāris, *is, e*; marked like the lines of a battlement.
crenulātus, *a, um*; slightly crenulated; zigzagged.

crepidula; a slipper; slipper-like.
cretaceous, *a, um*; chalky; belonging to the Chalk formation.
cribræus, *a, um*; sieve-like; full of openings.
crispus, *a, um*; curled.
crista-galli; cock's comb; like a cock's comb.
cristatus, *a, um*; crested; peaked.
cristella; little crest.
cruentatus, *a, um*; bloody.
crumena; a purse.
crustulentus, *a, um*; thin-crusted; wafer-like.
cryptopora; hidden-pored; having the pores concealed.
cubicodon; solid tooth; cubical teeth.
cucullæa; hood; hood-like.
cucullatus, *a, um*; hooded; furnished with a hood.
cūltridens; knife-tooth; knife- or sharp-toothed.
Cummingæ; after Lady Gordon-Cumming of Altyre, Morayshire.
cuneatus, *a, um*; wedged; wedge-shaped.
cuneiceps; wedge-headed.
cuneiformis, *is, e*; tapering in the form of a wedge.
cuniculus; the rabbit; cony-like.
cupressiformis, *is, e*; cypress-shaped; like the cypress-tree.
cupuliformis, *is, e*; cup-shaped; like an acorn.
curtansatus, *a, um*; shortened; curtailed.
curticerus, *a, um*; short-horned.
curtus, *a, um*; short.
curvicornis, *is, e*; bent-horned.
cūrvidens; bent-toothed; having the teeth bent inwards.
curvinodus, *a, um*; bent at the joints.
curvirostris, *is, e*; bent-beak; bent-jaw.
cuspidatus, *a, um*; pointed like a spear.
Cuvieri; in honour of Cuvier, the celebrated French naturalist.
cyathiformis, *is, e*; cup-shaped; goblet-shaped.
cyclostoma; circular-mouthed; circle-mouth.
cylus; a circle; round or circular-shaped.
cŷgnipes; swan-footed; like the swan's foot.
cylindricodon; cylindrical tooth.
cylindricus, *a, um*; cylindrical; cylinder-shaped.
ymbiiformis, *is, e*; boat-shaped; like a skiff.
ymbivum; a skiff or boat.
cymbula; a little skiff.
cyphus, *a, um*; crooked; humped; convex.

D

Dædæus, *a, um*; beautifully worked, as if by Dædalus.
dama; the fallow-deer; fallow-deer-like.
damæcornis, *is, e*; deer's-horn-like.
Davidsoni; after T. Davidson, paleontologist.

- decadactylus*, *a, um*; ten-fingered; ten-rayed.
decipiens; deceptive; doubtful.
declivis, *is, e*; sloping; bending downwards.
decoratus, *a, um*; decorated; ornamented with figure-work.
decurrens; running down along; extending.
decussatus, *a, um*; arranged in pairs that alternately cross each other.
definitus, *a, um*; definite; determined.
defossus, *a, um*; deeply buried; sunken.
Delabèchei; after Sir Henry Delabèche, geologist.
delicatulus, *a, um*; rather delicate; slender.
deltoides; shaped like the Greek letter Δ, delta; trowel-formed.
dendrius; a coin; in form of a coin.
dendrinus, *a, um*; tree-like; branching like a tree.
dendrophyllodes; tree-leaf-like; reticulated like the leaf of a tree.
dentalium; resembling the tooth-shell or *dentalium*.
dentalus, *a, um*; toothed; notched.
denticulatus, *a, um*; denticulated; small-toothed.
dentifer, *a, um*; toothed; furnished with teeth-like processes.
deplæxus, *a, um*; wound round; folded round.
depressus, *a, um*; depressed; slightly hollow.
Derbiensis, *is, e*; of or belonging to Derbyshire.
Deslongchampsii; in honour of M. Deslongchamps, geologist.
desmophyllus, *a, um*; bundle-leaved; in leaf-like clusters.
destructor; a destroyer; feeding on others.
D'Urbanii; in honour of D'Urban the naturalist.
Devoniensis, *is, e*; of or belonging to Devonshire.
dichotomus, *a, um*; dividing into two; branching into two; forked.
dicranocerus, *a, um*; having two-forked horns.
dictyota; set with netting.
didymus, *a, um*; double; twinned.
difformis, *is, e*; shapeless; ill-formed.
digitaliformis, *is, e*; finger-like; fingered.
digitalus, *a, um*; finger-like, as the leaves of the horse-chestnut.
digona; two-cornered.
dilatatus, *a, um*; dilated; widened; spread out.
dimidiatus, *a, um*; halved; divided in two.
discoideus, *a, um*; quoit-shaped; disc-like.
discretus, *a, um*; divided.
discus; a quoit; in the form of a quoit.
dispar; unlike; unequal.
dissectus, *a, um*; dissected; cut asunder.
dissimilis, *is, e*; unlike; unsymmetrical.
distans; distant; standing apart.
distichus, *a, um*; in two rows; double-rowed.
distortus, *a, um*; distorted; irregular in shape.
divaricatus, *a, um*; straggling; wide apart.
Dixoni; after Dixon, the author of 'Fossils of Sussex.'
dolabra; an axe; in the form of an axe.
dolabriformis, *is, e*; axe-shaped.

DOL — EUG

doliáris, *is, e*; tun-shaped ; barrel-like.

dólichodeirus; long-necked.

dolium, a cask ; *dolílus*, a little cask.

donax; a reed.

dorsális, *is, e*; belonging to the back ; dorsal ; having a dorsal ridge.

dorsátus, *a, um*; high-backed.

draconocéphala; dragon's head.

dúbius, *a, um*; doubtful ; uncertain.

dumétosus, *a, um*; bushy ; tufty.

duplicátus, *a, um*; doubled ; folded in two.

duriúsculus, *a, um*; rather hard ; hardish.

E

ebárneus, *a, um*; ivory-like ; having the texture of ivory.

echinátus, *a, um*; spiny ; covered with spines like the hedgehog.

echinóphorus, *a, um*; thorny ; bearing spines.

edéntulus, *a, um*; toothless.

éditus, *a, um*; lofty.

edulknus, *a, um*; edible ; capable of being eaten.

edális, *is, e*; edible ; used as food.

effóssus, *a, um*; dug out.

Egertoni; after Sir Philip Egerton, fossil ichthyologist.

Eggénsis, *is, e*; from the Isle of Egg, Hebrides.

Ehrenbérghii; after Ehrenberg, the great German microscopist.

Eifelensis, *is, e*; from Eifel, in Germany—Lower Rhine.

eláphus; the stag or red-deer ; stag-like.

elégans; elegant ; handsome in form.

elephantoides; elephant-like.

Elginénsis, *is, e*; found at or belonging to Elgin, in Morayshire.

ellípticus, *a, um*; in the form of an ellipse (oval).

elongátus, *a, um*; lengthened ; drawn out.

emarginátus, *a, um*; emarginate ; having a notch at the end, as if a piece

had been taken out.

empleura; full-sided.

enórmis, *is, e*; enormous ; unusually large.

énsifer, *a, um*; sword-bearing ; having pointed processes.

énsis; a sword ; tapering like a sword.

eoceanus, *a, um*; found in the Eocene or Lower Tertiaries.

epíppium; a saddle ; like a saddle.

equisetiformis, *is, e*; mare's-tail-shaped ; like the marsh plant equisetum.

erínáceus, *a, um*; hedgehog-like ; resembling the hedgehog.

ermineus, *a, um*; like the ermine or weasel.

erósus, *a, um*; gnawed ; bitten away.

erugátus, *a, um*; not wrinkled ; smooth, from marks having been worn away.

escharóides; like a chafing-dish ; grate-shaped.

eoínus, *a, um*; pike-like ; relating to the pike-fish.

euglyphus, *a, um*; well-carved ; distinctly marked.

edūdus; well-toothed.
eubmphalus, *a*, *um*; well centred or bossed.
eupterygius, *a*, *um*; well finned or winged.
eurygnathus; wide-jawed; broad-jawed.
evālus, *a*, *um*; torn out.
exaltātus, *a*, *um*; raised; prominently elevated.
exardātus, *a*, *um*; defaced as to marks previously existing; worn off.
excavātus, *a*, *um*; hollowed out; scooped out.
exēlātus, *a*, *um*; lofty; high in stature.
excisus, *a*, *um*; cut off; cut out; erased.
extērus, *a*, *um*; projecting.
exērus, *a*, *um*; corroded; worn in holes.
exolātus, *a*, *um*; worn out; defaced.
expānsilābrum; broad-lipped; spreading out at the lip.
expānsus, *a*, *um*; widely spread; spread out.
explandātus, *a*, *um*; spread out; clearly seen.
exsculptus, *a*, *um*; deeply sculptured; sculptured out.
extenuātus, *a*, *um*; thinned away; drawn out into a thin edge.
exūtus, *a*, *um*; stripped off; removed.

F

fāba; a bean; like a bean.
fabagēlla; little bean; like a little bean.
falcātus, *a*, *um*; falcate or sickle-shaped.
fālcifer, *a*, *um*; sickle-bearing; armed with sickle-like processes.
fallax; fallacious; deceptive.
fasciārius, *a*, *um*; bandage-like; band-shaped.
fasciātus, *a*, *um*; bandaged; striped.
fasciculātus, *a*, *um*; faggot-like; in bundles.
fasciculus; a faggot or bundle; in tufts.
fastigiātus, *a*, *um*; pointed; peaked like a roof.
favosoides; honeycomb-like.
favōsus, *a*, *um*; arranged like a honeycomb; honeycombed.
fenestrātus, *a*, *um*; window-paned; reticulated.
fēroz; fierce; fitted for fierce work; sharp-pointed.
fērtilis, *is*, *e*; fertile; bearing seed.
fibrōsus, *a*, *um*; fibrous; full of fibres.
fibulātus, *a*, *um*; broach-like.
ficoides; fig-like.
ficulneus, *a*, *um*; belonging to the fig-tree.
fīdūla; a little fiddle or kit.
filiciformis, *is*, *e*; fern-shaped; fern-like.
filiformis, *is*, *e*; filiform; thread-like.
filipendāris, *is*, *e*; thread-finned or winged; having thread-like fins.
filitextus, *a*, *um*; woven like threads; formed of interlacing filaments.
filigrānus, *a*, *um*; thread-grained; fine-grained.
filōsus, *a*, *um*; thread-like; thready.

FIM — GAL

- fimbriatus*, *a, um*; fringed.
fissicostatus, *a, um*; having divided ribs; cleft-ribbed.
fissura; a cleft; having a cleft.
fissurella; a little cleft.
fitula; a pipe or tube.
fitulosus, *a, um*; pipe-like; composed of small tubes.
Fittoni; after Dr Fitton, the geologist.
flabellatus, *a, um*; spread out like a fan.
flabelliformis, *is, e*; fan-shaped; flabelliform.
flabellulus; a little fan.
flabellum; a fan; fan-like.
flagelliformis, *is, e*; whip-shaped; thong-like.
Flemingii; after Professor Fleming of Edinburgh, naturalist.
flexicostatus, *a, um*; bent-ribbed.
flexuosus, *a, um*; bent; crooked.
flocosus, *a, um*; wool-like; fleecy.
florealis, *is, e*; flowery; flower-like.
floriceps; flower-headed; like a head of flowers.
florigemma; flowery-gemmed.
fluctuatus, *a, um*; waving; wavy.
foliatus; digging; burrowing in the earth.
foliaceus, *a, um*; leaf-like; leafy.
foliosus, *a, um*; leafy; abounding in leaves.
folium; a leaf or thin plate.
fonticola; fountain-dwelling; living in springs.
fontinalis, *is, e*; of or belonging to fresh-water springs.
foraminosus, *a, um*; full of small holes.
Forbesii; in honour of the late Edward Forbes.
formicatus, *a, um*; ant-like.
formosus, *a, um*; fair, beautiful.
formicatus, *a, um*; arched.
fossilis, *is, e*; fossil or extinct, in contradistinction to recent or living.
foveolatus, *a, um*; pitted; covered with pit-like markings.
frondosus, *a, um*; branching; branchy.
frontalis, *is, e*; having a large front or forehead.
fundalis, *is, e*; rope-like; rope-shaped.
fungiformis, *is, e*; fungus-shaped; mushroom-like.
fungoides; fungus-like.
funiculatus, *a, um*; cord-like; corded.
furcatus, *a, um*; forked; branching in two.
furcillatus, *a, um*; marked with slightly bifurcating lines.
fuscatus, *a, um*; dark; tawny.
fusiformis, *is, e*; spindle-shaped; tapering at both ends.

G

- gagateus*, *a, um*; agate-like; formed of agate.
galvus; a helmet; helmet-like.

- galioïdes*; like the plant *galium*, or "ladies' bed-straw."
Gaultianus, *a, um*; of or belonging to the Gault.
Gaultianus, *a, um*; belonging to, or peculiar to, the Gault.
geminans; doubling; twin-form.
geminatus, *a, um*; doubled; in twins.
gemmatus, *a, um*; studded with gems; beaded.
geométricus, *a, um*; arranged in geometrical order.
gibberulus, *a, um*; somewhat humped; convex, or gibbous.
gibbosus, *a, um*; gibbous; humped; tumid.
Gibbsii; after Mr Gibbs, collector to the Geological Survey.
gibbus, *a, um*; humped; having a hump or sudden rise.
giganteus, *a, um*; gigantic; unusually large.
gigas; a giant.
glaber, *a, um*; smooth.
glabrispinus, *a, um*; smooth-spined.
glândifer, *a, um*; acorn-bearing; gland-bearing.
globiceps; globe-headed; round-headed.
globosus, *a, um*; globular; globose.
globulâris, *is, e*; globular; globe-shaped.
glomeratus, *a, um*; gathered in a mass; wound up like a clue.
glyphurus, *a, um*; carved tail; sculptured tail.
Goldfussi; after Goldfuss, the celebrated naturalist.
gonygloïdes; knob-like.
goniodactylus, *a, um*; corner-fingered.
Gothlandicus, *a, um*; of or from Gothland (Sweden).
gracilis, *is, e*; slender; slight in form.
gradatus, *a, um*; step by step; graduated.
graminoides; grass-like; resembling the grasses.
grandispinus, *a, um*; great-spined; having large spines.
grandævus, *a, um*; ancient; of great age; primeval.
grandis, *is, e*; great.
Grantoni; from Granton quarry, near Edinburgh.
granulatus, *a, um*; granulated; having the surface dotted with small grains.
granulosus, *a, um*; covered with small granules; granular.
graphicus, *a, um*; written on; inscribed with lines like writing.
Grayii; after Dr Gray of the British Museum.
Greenockii; after the Earl of Greenock, mineralogist.
Greenoughii; after Mr Greenough, English geologist.
gregarius, *a, um*; gregarious; occurring in flocks, or masses.
Griestoniensis, *is, e*; from Grieston quarry (Silurian) in Peeblesshire.
Griffithii; after Sir Richard Griffith, the Irish geologist.
grossicornus, *a, um*; thick-coned.
grumosus, *a, um*; grumous; in the form of small clusters of grapes.
gryphæoides; gryphæa or gryphite-like; like the beaked shell gryphæa.
guttatus, *a, um*; studded with guttæ, or small drops.
gyræus, *a, um*; circular; twisted-like; greatly twisted.

H

- haliotoides*; shaped like the haliotis or ear-shell.
Hallianus, *a*, *um*; after Professor J. Hall of New York.
halocyon; sea-dog; sea-dog-like.
hamatus, *a*, *um*; hooked; hooked-like.
Hantoniensis, *is*, *e*; belonging to or found in Hampshire (Hants).
harpeiformis, *is*, *e*; harp-shaped; in the form of a harp.
harpula; a little harp.
hastalis, *is*, *e*; spear-like; spear-shaped.
hastatus, *a*, *um*; formed like a dart or spear.
hastiformis, *is*, *e*; dart-shaped.
Hastingsia; after the Marchioness of Hastings, collector.
haustellum; a little bucket; bucket-like.
hebetus, *a*, *um*; blunt.
Hebridicus, *a*, *um*; of or belonging to the Hebrides.
helianthella; like a little sunflower—said of certain corals.
helianthoides; sunflower-like; rayed like the sunflower.
helicanus, *a*, *um*; whorled like the snail-shell (*helix*).
helicotides; snail-shell-like.
helictes; ear-rings; ear-drops.
helecteroides; ear-ring-like; ear-drop-like.
hervelloides; cabbage-like; shaped like a head of cabbage.
hemicidaroides; hemicydaris-like (a fossil sea-urchin).
hemisphericus, *a*, *um*; hemispherical in form.
hemistoma; half-mouthed.
Henslowii; after Professor Henslow of Cambridge, botanist.
heterodon; irregular-toothed.
heterogæneus, *a*, *um*; irregular in composition or parts.
heteromorphus, *a*, *um*; irregular in form.
heterophyllus, *a*, *um*; irregular-leaved.
heterurus, *a*, *um*; irregular-tailed.
hexagonus, *a*, *um*; six-cornered or six-sided.
hians; gaping.
Hibbertii; after Dr Hibbert of Edinburgh, geologist.
Hibernicus, *a*, *um*; found in, or belonging to Ireland; Irish.
hieroglyphicus, *a*, *um*; marked as if with hieroglyphics.
hippocastanum; horse-chestnut.
hippocrepis; horse-shoe.
hippopodium; horse-hoof; like the horse-hoof.
hippopus; horse-hoof (in the form of).
hirudo; a leach; leach-like.
hispidulus, *a*, *um*; somewhat rough or bristly.
hispidus, *a*, *um*; rough; covered with long rigid hairs.
hiulcus, *a*, *um*; gaping.
humerosus, *a*, *um*; broad-shouldered; humped.
Huttoni; after Dr Hutton, the celebrated Scotch geologist.

HUT — JUB

Huttonianus, *a, um*; after Mr Hutton of Newcastle, fossil botanist.
hyalatus, *a, um*; glassy; having the lustre of glass.
hybridus, *a, um*; hybrid; intermediate between two species.
hymenophyllóides; membranous, leaf-like.
hypocrateriformis, *is, e*; salver-shaped.
hypnoides; hypnum-like; like the common moss hypnum.
hystrix; a porcupine; covered or beset with spines.

I

Ibbetsoni; after Captain Ibbetson, geologist.
iconidáctylus, *a, um*; twenty-fingered.
imbricatárus, *a, um*; covered with tiles; tile-like.
imbricátus, *a, um*; imbricated; overlapping like tiles.
impar; unequal; having unequal parts.
impressus, *a, um*; impressed; stamped.
inæquális, *is, e*; unequal; not having equal parts.
inæquicostátus, *a, um*; unequally ribbed.
ínánis, *is, e*; void; empty.
ínárus, *a, um*; incised; cut in; slashed.
inconstans; inconstant; not always of one size or form.
incrassátus, *a, um*; thickened.
incrústans; incrusting other substances, as coral-growth, &c.
incurvus, *a, um*; incurved; bent in.
inflátus, *a, um*; inflated; swollen, as if blown up.
infirmis, *is, e*; shapeless; without form.
infundibuliformis, *is, e*; funnel-shaped.
ingens; huge; unusually large.
intercellulóus, *a, um*; intercellular; cell within cell.
intermédius, *a, um*; intermediate (in size or form).
interstinctus, *a, um*; divided.
intertextus, *a, um*; interwoven; ramifying.
intórtus, *a, um*; twisted inwards.
intumescens; swelling up.
irradians; not radiating from a common centre.
irreguláris, *is, e*; irregular; not disposed in regular order.
isocárdia; equal heart (regularly heart-shaped).
isogonóides; equiangular-like.

J

jacólem; a dart; dart-shaped.
Jamesii; after Colonel James of the Government Survey.
Jamesoni; after Professor Jameson of Edinburgh, geologist.
Jardinii; after Sir William Jardine, naturalist.
Jewettii; after Mr Jewett, American geologist.
jubátus, *a, um*; maned; having a mane-like fringe.

JUG — LEI

- jugālis*, *is, e*; yoked together; conjoined.
jugōsus, *a, um*; yoked together; closely conjoined.
Jukesii; after Mr Jukes of the Geological Survey of Ireland.
jūnceus, *a, um*; rush-stem-like.
juniperinus, *a, um*; juniper-like; like the juniper-berry.

K

- Keuperinus*, *a, um*; belonging to the Keuper, or Upper Trias.
Königii; after König, the Belgian palaeontologist.

L

- labiātus*, *a, um*; labiate; having lips.
Labradoricus, *a, um*; of or belonging to Labrador; occurring in Labrador.
labyrinthicus, *a, um*; labyrinthine; full of intricate windings.
lācerus, *a, um*; torn; ragged.
laciniātus, *a, um*; slashed.
lācteus, *a, um*; milky; white as milk.
lacunōsus, *a, um*; having deep depressions.
laviceps; smooth-head.
lavigātus, *a, um*; smoothened; polished.
lavis, *is, e*; smooth; polished.
lavisimus, *a, um*; very smooth; exceedingly smooth.
laviāculus, *a, um*; slightly smooth.
Lamarckii; after Lamarck, French naturalist.
lamellōsus, *a, um*; in very thin plates.
laminātus, *a, um*; laminated; in thin plates.
lanceolātus, *a, um*; lanceolate; spear-shaped.
Landsburgii; after the Rev. Dr Landsborough, algæologist.
laqueatus, *a, um*; carved; adorned with fretted work.
latecūda; broad-tailed.
lateseptātus, *a, um*; widely divided; having septa or partitions wide apart.
lati-costātus, *a, um*; broad-ribbed.
latidens; broad-toothed.
latifolius, *a, um*; broad-leaved.
latifrons; broad front; broad-fronted.
latimānus, *a, um*; broad-handed; broad-finned.
latipennis, *is, e*; broad-finned or winged.
latissimus, *a, um*; broadest; very broad.
latiāculus, *a, um*; broadish; somewhat broad.
latus, *a, um*; broad.
latus, or *lavātus*, *a, um*; washed.
laxus, *a, um*; loose; loosely arranged.
leiodus; smooth-tooth.
leioptērus; smooth-ribbed.
leioēmus; smooth-bodied.

- lemniscatus*, *a, um*; labelled.
lenticularis, *is, e*; lenticular; lens-shaped.
lenticulatus, *a, um*; lens-shaped, having a double-convex surface.
lenticularius, *a, um*; lentil-like.
lentiformis, *is, e*; lens-shaped; in the form of a lens.
lentus, *a, um*; slow.
lepidotus, *a, um*; leprous; covered with small peltate scales.
leporinus, *a, um*; resembling the hare; hare-like.
leptocephalus, *a, um*; slender-headed.
leptodus; slender-tooth, slender-toothed.
leptognathus; slender-jawed.
leptopterus, *a, um*; slender-finned.
leptorhinus, *a, um*; slender-nosed; slender-snouted.
leptosoma; slight-bodied; slender-bodied.
leptosteus, *a, um*; slender-boned.
Liasianus, *a, um*; of or belonging to the Lias formation.
Liasicus, *a, um*; of or belonging to the Lias formation.
lichenoides; lichen-like.
lignarius, *a, um*; wood-like; of wood.
ligulatus, *a, um*; ligulate; strap-shaped.
lima; a file (like a file).
limbatus, *a, um*; bordered.
limularus, *a, um*; limulus-tailed; having a pointed tail like the king-crab.
linctus, *a, um*; licked; smoothened as if by licking.
Lindleyi, *Lindleyanus*, *a, um*; after Dr Lindley, the eminent botanist.
linedtus, *a, um*; marked with lines, striated.
lineolatus, *a, um*; marked with little lines.
lingua; the tongue; tongue-like.
lingua-bovis; ox-tongue; shaped like an ox's tongue.
linguiformis, *is, e*; tongue-shaped.
lingulatus, *a, um*; in the form of a tongue.
liratus, *a, um*; lyre-shaped; in the form of a lyre.
Listeri; after Dr Lister, geologist.
litteratus, *a, um*; lettered; marked as if inscribed with letters.
litusiformis, *is, e*; trumpet-shaped.
lobatus, *a, um*; lobate; divided by a determinate number of segments.
lobifolius, *a, um*; lob-leaved.
loculosus, *a, um*; partitioned.
Logani; after Sir William Logan, State Geologist for Canada.
lonchodon; long tooth, slender-toothed.
lonchitis; the fern "adder's tongue;" like the adder's tongue.
longibracteatus, *a, um*; furnished with long bracts.
longiceps; long-headed.
longicollis, *is, e*; long-necked.
longidens; long tooth; long-toothed.
longifolius, *a, um*; long-leaved; having long leaves.
longimanus; long-handed.
longirostris, *is, e*; long-beaked; long-snouted.
longissimus, *a, um*; the longest; of unusual length.

LON — MAR

longitudinalis, *is, e*; lying lengthwise; long and narrow.
Lonsdalei; after Mr Lonsdale, palaeontologist.
lophodon; crested-tooth.
loricatus, *a, um*; loricated; resembling a coat of mail.
Ludensis; from or belonging to Ludlow, in Shropshire.
lunatus, *a, um*; moon-shaped; crescent-formed.
lunulatus, *a, um*; lunulate; half-moon-shaped.
lycopodoideus; lycopodium-like; club-moss-like.
Lyellii; after Sir Charles Lyell, the geologist.
lyratus, *a, um*; lyrate; lyre-shaped.

M

M'Coyanus, *a, um*; after Mr M'Coy of Melbourne, geologist.
M'Clintocki; after Sir L. M'Clintock the Arctic voyager.
macilentus, *a, um*; lank; meagre; scraggy.
macrocaulis, *is, e*; long-stemmed; long-stalked.
macrocheirus, *a, um*; long-handed; having long pectoral fins.
macrodactylus, *a, um*; long-fingered.
macrodiscus, *a, um*; long-disked; having long leaf-scars.
macrodon; long tooth; long-toothed.
macrolepidotus, *a, um*; long-scaled; large-scaled.
macromus, *a, um*; long shoulder-blade; slender-shouldered.
macronyx; long claw; long-clawed.
macrophthalmus, *a, um*; long- or large-eyed.
macrophyllus, *a, um*; long-leaved.
macroponum; long cheek; long-jawed.
macropterus, *a, um*; long-winged; long-finned.
macropterygius, *a, um*; long tail-finned.
macrospindylus, *a, um*; long-backboned; long-spined.
macrostomus, *a, um*; long- or large-mouthed.
macrostus, *a, um*; long- or large-eared.
macrurus, *a, um*; long-tailed.
macroides; like, or having the form of the shell *macro*.
maculatus, *a, um*; spotted; mackled.
major, *or, us*; the greater.
Malcolmsoni; after Dr Malcolm of Elgin, Morayshire.
malleus; a mallet, or hammer; the shell *malleus*.
mammillaris, *is, e*; mammillated; pap-shaped.
mammillatus, *a, um*; nipple-shaped; mammillary.
mammilliferus, *a, um*; pap-bearing; covered with pap-like points.
mancus, *a, um*; imperfect; defective.
mandibularis, *is, e*; beaked; bill-like; mandibular; furnished with mandibles.
mandibulatus, *a, um*; bill-shaped; furnished with a mandible.
Mantelli; after Dr Mantell, the geologist.
Marcouanus, *a, um*; after M. Jules Marcou, geologist.
margaritaceus, *a, um*; pearly; having the lustre of pearl.

MAR — MON

- margaritulus*, *a, um*; little pearl; seed-pearl.
margindatus, *a, um*; bordered; having a distinct border.
marginsella; little margin (a genus of shells).
Martini; after Martin, the palæontologist of Derbyshire.
mastodonticus, *a, um*; nipple-toothed; teeth with tubercles.
maximus, *a, um*; greatest; the largest.
meandrinus, *a, um*; meandering; serpentine.
meandroides; like the *meandrina* or brain-coral.
mædius, *a, um*; intermediate; middling.
medullaris, *is, e*; medullary; having a pith.
megilodon; large tooth; large-toothed.
megalophyllus, *a, um*; large-leaved.
megalothis, *is, e*; great-eared; great ear.
melacactoides; melocactus-like; resembling the melocactus.
melania; black (a genus of shells).
melanoides; like the shell *melania*; black-like.
Melitensis, *is, e*; of or belonging to the island of Malta.
membranaceus, *a, um*; membrane-like; formed of membrane.
meniscoides, *a, um*; meniscoid; concavo-convex.
mespiliformis, *is, e*; medlar-shaped.
micans; shining; glistening with enamel.
midstron; little star.
microacanthus, *a, um*; small-spined.
microcephalus, *a, um*; small-headed.
microdus; small tooth; minute tooth.
microlepidotus, *a, um*; small-scaled.
microphyllus, *a, um*; small-leaved.
micropleurus, *a, um*; small-sided.
microporus, *a, um*; small-pored.
Milleri; after Mr Hugh Miller, geologist.
minimus, *a, um*; the least; very small.
minor, *or, us*; the less, less.
minutulus, *a, um*; very minute; minutely small.
minutus, *a, um*; minute, small.
miocænus, *a, um*; found in the Miocene or Middle Tertiaries.
mirabilis, *is, e*; wonderful; admirable.
mitriformis, *is, e*; mitre-shaped; mitriform.
mitratus, *a, um*; mitre-like; in the form of a mitre.
modiola, *modiolus*; a bushel-measure (a genus of shells).
modiolaris, *is, e*; bushel-shaped.
molendinæus, *a, um*; mill-sail-shaped.
Monænsis, *is, e*; belonging to the Isle of Man (Mona).
montle; a necklace; bead-string-like.
monileformis, *is, e*; necklace-shaped; bead-like.
monilectus, *a, um*; necklace-covered.
moniliferus, *a, um*; beaded; necklace-like.
monóceros; one-horned; the narwhal.
monticulatus, *a, um*; having many small projections; covered with conical points.

MOO — NIT

- Moorei*; after Mr C. Moore of Bath, geologist.
Morrisi; after Professor Morris of London, geologist.
mosaicus, *a, um*; tessellated like mosaic work; patterned.
mucronatus, *a, um*; sharp-pointed; dagger-like.
multicarinatus, *a, um*; having many keels or ridges.
multiceps; many-headed.
multidigitatus, *a, um*; many-fingered.
multifidus, *a, um*; many-cleft; having many segments.
multigranulatus, *a, um*; many-grained; dotted with numerous grains.
multitorquatus, *a, um*; many times twisted; often twisted.
multinervus, *a, um*; many-nerved.
multinodus; many-knotted.
multiradiatus, *a, um*; many-rayed.
multisulcatus, *a, um*; many-furrowed.
Munsterianus, *a, um*; after Count Munster, geologist.
Murchisoni; after Sir Roderick Murchison, the geologist.
muricatus, *a, um*; like the shell *murex*.
Murrayanus, *a, um*; after Dr Murray of Yorkshire.
muscariformis, *is, e*; brush-shaped.
musculus; a little mouse; mouse-like.
mutabilis, *is, e*; mutable; changeable.
nudus, *a, um*; without a beard; beardless.
nysa; gaper (a genus of shells).
mysticetus, *a, um*; sperm-whale-like.
mytiloides; like the *mytilus*, or mussel-shell.

N

- nanus*, *a, um*; dwarfish.
napiiformis, *is, e*; turnip-shaped.
nasutus, *a, um*; having a prominent nose.
nautiloidea; resembling the shell *nautilus*.
nautilus; a little sailor (a genus of chambered shells).
navicula; a little ship; boat-shaped.
navicularis, *is, e*; ship-like.
navis; a ship.
neglectus, *a, um*; neglected; overlooked.
nemorialis, *is, e*; frequenting woods; of the grove.
Neocomiensis, *is, e*; of or belonging to the *Neocomian* or Lower Greensand formation.
nephrocarpus, *a, um*; kidney-fruited; fruit kidney-shaped.
nervosus, *a, um*; full of nerves.
nestis, *is, e*; entwined; interlaced.
Niagarensis; of or belonging to the Niagara district.
Nicoli; after Professor Nicol of Aberdeen, geologist.
nitens; bright; shining.
nitidulus, *a, um*; rather neat.
nitidus, *a, um*; neat; pretty.

niveus, a, um; snowy; white as snow.
noctulus, a, um; belonging to the twilight; of twilight habits.
nodosus, a, um; knotty; knobbed.
nodulosus, a, um; in small knots.
Nöggerdii; after Dr Nöggerath, German fossil botanist.
normalis, is, e; normal; according to rule; following the usual structure.
Norvegicus, a, um; of or belonging to Norway.
notatus, a, um; marked; stamped with a mark.
nucleus; a kernel; kernel-like.
nucula; a little nut (a genus of bivalve shells).
nudus, a, um; naked; uncovered.
numismalis, is, e; coin-like (round-lenticular).
nummarius, a, um; coin-like; coin-shaped.
nummiformis, is, e; coin-shaped; in the form of small coins.
nummularius, a, um; nummulus-like in form.
nummulus, or little coin (a genus of foraminiferous shells, so called from their form).
nūtans; nodding; bent downwards.

0

obconicus, a, um; rather conical; slightly conical.
obesus, a, um; fat; plump in form.
obtus, a, um; oblate; broader than long; broadly-round.
obliquatus, a, um; oblique; slanting.
obliquus, a, um; oblique; leaning to one side.
oblongus, a, um; oblong; rather long; longer than broad.
obovatus, a, um; egg-shaped; with the broad end uppermost.
obsoletus, a, um; obsolete; scarcely distinguishable at the margin.
obtusilobus, a, um; obtuse-lobed; having blunt lobes.
obvolatus, a, um; folded; tied about.
ocellatus, a, um; furnished with little eyes, or eye-specks.
ochraceus, a, um; ochrey; having the colour of ochre.
octoplicatus, a, um; eight-folded.
oculatus, a, um; full of eyes, or eye-like dots.
oculinus, a, um; eye-like; spotted with eyes.
Oldhami; after Professor Oldham of Dublin.
olivaceus, a, um; olive-like; olive-coloured.
olla; a pot; pot-shaped.
onychius, a, um; shaped like a little claw.
ocephalus, a, um; egg-headed; broad end up.
Ooliticus, a, um; of or belonging to the Oolite.
opalinus, a, um; opal-like; having the lustre of opal.
opercularis, is, e; furnished with an opercular bone; opercular.
oppositus, a, um; opposite; placed on opposite sides.
orbicula; rounded; little orb (a genus of shells).
orbicularis, is, e; orbicular; orb-shaped.
Orbigny; after D'Orbigny, the celebrated French savan.

ORD — PAT

ordinarius, *a, um*; ordinary; common; frequent.
organum; an organ; arranged like the pipes of an organ.
ornatissimus, *a, um*; most ornamented; highly ornamented.
ornatus, *a, um*; ornamented; adorned.
ornithocephalus, *a, um*; bird-headed; like a bird's head.
oryza; a grain of rice; like a rice-grain.
osculifer, *a, um*; having a little mouth.
osseus, *a, um*; bony; composed of, or armed with, bone.
ostreaformis, *is, e*; oyster-shaped.
ovalis, *is, e*; oval; in the form of an egg.
ovatus, *a, um*; ovate; egg-shaped.
oviformis, *is, e*; egg-shaped; ovate.
ovoidea; egg-like; in the form of an egg.
ovula; a little egg (a genus of shells).
O'weni; after Professor Owen, the celebrated naturalist.

P

packyderma; thick-skinned; thick-barked.
packygnathus; thick-jawed; strong-jawed.
packyomus; thick shoulder-blade; thick-shouldered.
packypterus, *a, um*; thick-finned; thick-winged.
palestus, *a, um*; chaffy.
pallidus, *a, um*; pale-coloured.
palmatus, *a, um*; palmate; having five lobes like the fingers of the human hand.
palpebratus, *a, um*; having large eyelids; deeply fringed.
panduratus, *a, um*; fiddle-shaped.
pandus, *a, um*; bent downwards.
paniceus, *a, um*; bread-like; in the form of a cake of bread.
papaveraceus, *a, um*; poppy-like.
papilionatus, *a, um*; butterfly-shaped.
papillatus, *a, um*; nipple-like; covered with papilli.
papillosus, *a, um*; covered with numerous tubercles.
paradoxicus, *a, um*; paradoxical; puzzling; questionable.
paradoxus, *a, um*; questionable; extraordinary.
parasiticus, *a, um*; parasitic; living on or attached to another.
pardoides; panther-like; allied to the panther.
Parisiensis, *is, e*; belonging to Paris; found near Paris.
Parkinsonis, *is, e*; after Parkinson the palæontologist.
pavidens; small-toothed.
pavulus, *a, um*; very small; diminutive.
pavus, *a, um*; small.
patella; a small plate; the knee-pan; the limpet-shell.
patellaris, *is, e*; limpet-shaped.
patelliformis, *is, e*; patella or limpet-shaped.
patens; spreading; exposed.
patulosus, *a, um*; broad; expanding.

- pátulus*, *a, um*; broad; spread out.
páucidens; few-toothed; having few teeth.
paucifólius, *a, um*; few-leaved; having few leaves.
paucisulcátus, *a, um*; having few furrows or depressions.
pauperátus, *a, um*; impoverished; meagre.
parillóus, *a, um*; resembling a little stake.
Peachii; after Mr Charles Peach, collector and discoverer.
pecten; a comb (the scallop-shell); comb-like.
pectinátus, *a, um*; pectinated; toothed like a comb.
pectínifer, *a, um*; comb-bearing.
pectinoides; comb-like.
pectúnculus; little comb (a genus of shells).
pedástris, *is, e*; furnished with feet; footed.
pédum; a shepherd's crook.
pedunculátus, *a, um*; furnished with a footstalk or peduncle.
pelágicus, *a, um*; belonging to the deep sea.
pellis serpéntis; serpent's skin.
pellácidus, *a, um*; quite transparent; pellucid.
pellátus, *a, um*; buckler or half-moon shaped.
pelliformis, *is, e*; in the form of a half-moon buckler.
pencilus; a brush or pencil.
Pengellyi; after M. Pengelly of Torquay, geologist.
pennáformis, *is, e*; feather-like; feather-shaped.
pennicístis, *is, e*; feather-ribbed.
pentágonus, *a, um*; five-cornered; pentagonal.
pentrematoides; like or resembling the pentremite.
perámpus, *a, um*; very large; unusually large.
perarmátus, *a, um*; completely armed.
perattenuatus, *a, um*; much attenuated; very slender.
peregrínus, *a, um*; foreign; wandering.
perforátus, *a, um*; perforated; full of holes or pores.
perlátus, *a, um*; very broad; very wide; unusually wide.
Permianus, *a, um*; of or belonging to the Permian system.
perornátus, *a, um*; highly ornamented; unusually ornamented.
perováis, *is, e*; very oval; almost round.
perreticulátus, *a, um*; highly reticulated; reticulated all over.
perrugátus, *a, um*; very full of wrinkles; extremely wrinkled.
personátus, *a, um*; personate; mask-like.
pertúsus, *a, um*; pierced; struck through.
pes-anseris; goose-foot; shaped like a goose's foot.
pes-ránae; frog-foot; shaped like a frog's foot.
petalíferus, *a, um*; bearing petal-like appendages.
petalífórmis, *is, e*; shaped like the petals of a flower.
petiolátus, *a, um*; furnished with a petiole or leaf-stalk.
petrócolus, *a, um*; stone-dwelling; living in stone.
phaseolínus, *a, um*; kidney-bean-shaped.
phaseolus; in the form of a kidney-bean.
Phillipsii; after Professor Phillips of Oxford, geologist.
phrdgmiger, *a, um*; separated by thin partitions; partitioned.

- pictus*, *a*, *um*; painted.
- pileatus*, *is*, *e*; in the form of a peaked hat or cap.
- pileatus*; like a peaked hat (a genus of limpet-like shells).
- piliferus*, *a*, *um*; hair-bearing; hair-pointed.
- pillula*; a little ball or pill.
- pinaster*; like the pine-tree, *pinaster*.
- piniformis*, *is*, *e*; pine-shaped; pine-tree-like.
- pinna*; a fin; the bivalve shell *pinna*.
- piriformis*, *is*, *e*; pear-shaped, pyriform.
- piscatorius*, *a*, *um*; fishing; fish-catching.
- piscatorum*; of fishermen; used by fishers.
- pisiformis*, *is*, *e*; pea-shaped.
- pistilliformis*, *is*, *e*; pestle-shaped; in form of a pestle.
- pisum*; a pea; like a pea; pea-shaped.
- placentiformis*, *is*, *e*; placenta- or cake- shaped.
- planatus*, *a*, *um*; smoothed; plain.
- planiceps*; smooth-headed; flat-headed.
- planicostatus*, *a*, *um*; smooth-ribbed.
- planorbis*; even-whorled; having the spires lying in the same plane (a genus of spiral-circular shells).
- planulatus*, *a*, *um*; rather smooth; somewhat flat.
- platycephalus*, *a*, *um*; broad-headed.
- platyceps*; broad head; broad-headed.
- platynotus*; broad back.
- platyodon*; broad-toothed.
- platyphylus*, *a*, *um*; broad-leaved; expanded like a leaf.
- platypterus*, *a*, *um*; broad-finned.
- platypus*, *a*, *um*; broad-footed.
- platyrachis*; having a broad rachis or stalk.
- pleodon*; *pleiodus*; the larger-toothed.
- plica*; a fold or plait.
- plicatella*; a little fold or plait.
- plicatilis*, *is*, *e*; slightly folded, in small folds.
- plicatus*, *a*, *um*; folded, plaited.
- plicomphalus*, *a*, *um*; folded in the middle or navel.
- pliocenus*, *a*, *um*; found in the Pliocene or Upper Tertiaries.
- pluma*; a feather or plume.
- plumarius*, *a*, *um*; plume-like; feathery.
- plumbeus*, *a*, *um*; feathery.
- pluriradiatus*, *is*, *e*; many-rayed, as in certain corals.
- poculiformis*, *is*, *e*; cup- or goblet- shaped.
- poculum*; a cup or goblet; cup-shaped.
- podocarpoides*; like the *podocarpus*, one of the yews.
- politus*, *a*, *um*; polished; smoothed; not figured.
- Polluxfeni*; after the Rev. Mr Polluxfen, naturalist.
- polydactylus*, *a*, *um*; many-fingered.
- polygonatus*, *a*, *um*; many-angled; many-cornered.
- polygyrus*, *a*, *um*; many-twisted; many-circled.
- polymorphus*, *a*, *um*; many-shaped; of many forms.

- polyodus*, *a, um*; many-toothed.
polyommata; many-eyed.
polyphyllus, *a, um*; many-leaved.
polypodioides; like the fern *polypodium* or polypody.
polypondylus, *a, um*; having many vertebrae.
polystachya; many-spiked; many-eared.
polytoma; cut into many parts.
ponderosus, *a, um*; heavy; bulky.
porosus, *a, um*; full of pores; porous.
porrectus, *a, um*; stretched out.
Portlockii; after Major-General Portlock, geologist.
posterogenius, *a, um*; later-born; not the first of its kind.
præacutus, *a, um*; very acute; thin and sharp.
præambus, *a, um*; jagged as if bitten off.
pratensis, *is, e*; inhabiting meadow or river-land.
Prestvici; after Mr Prestwich of London, geologist.
Prevostii; after M. Constance Prevost, French geologist.
primævus, *a, um*; primeval; very ancient.
primigenius, *a, um*; original; first-born.
primordialis, *is, e*; primordial; first in order.
præcæus, *a, um*; ancient.
pristodontus, *a, um*; saw-toothed; jagged like a saw.
Pritchardi; after Mr Pritchard, the microscopist.
prodrus, *a, um*; ancient; belonging to the first ages.
problematicus, *a, um*; problematical; doubtful.
proboscoides, *a, um*; proboscis-like.
prokiferus, *a, um*; putting forth a new shoot.
propinquus, *a, um*; neighbouring; related to.
propterygius, *a, um*; fore-finned.
prostratus, *a, um*; prostrate; creeping on the ground.
prolatus, *a, um*; stretched forth; stretched out.
pruniformis, *is, e*; prune-shaped.
psilopora; having smooth pores; smooth-pored.
psittaceus, *a, um*; parrot-like; hooked like a parrot's bill.
psittacnus, *a, um*; parrot-like; bent like a parrot's bill.
pterocera; winged-horn; a genus of univalves; like the shell *pterocera*.
pteroides; wing-like; fern-like.
ptychoides; wrinkle-like.
pubescens; downy; covered with fine hairs.
pucillus, *a, um*; very small.
pulchellus, *a, um*; lovely; minutely pretty.
pulcher, *a, um*; beautiful.
pulcherrimus, *a, um*; fairest; very beautiful.
pulverulentus, *a, um*; covered as with small dust; powdery.
pulvinarium; a cushion; cushion-shaped.
pulvinatus, *a, um*; cushioned.
pumilus; a dwarf or pigmy.
punctatus, *a, um*; punctured; marked with dots; dotted.
pupa; a swathe or bandage; a genus of univalves.
Purbeckensis, *is, e*; from the isle of Purbeck in Dorsetshire.

PUS — RET

pusillus, *a, um*; very small; diminutive.
pustulatus, *a, um*; pustuled; covered with pustules.
pustuliferus, *a, um*; bearing pustules; marked with pustules.
pustulosus, *a, um*; full of or all over with pustules.
pygmaeus, *a, um*; diminutive in size; pigmy-like.
pyramidalis, *is, e*; pointed like a pyramid.
pyriformis, *is, e*; pyriform; pear-shaped.

Q

quadrangulâris, *is, e*; quadrangular; four-sided.
quadratus, *a, um*; square-shaped.
quadricostatus, *a, um*; four-ribbed.
quadrifidus, *a, um*; cleft or split into four.
quadrigeminus, *a, um*; four times doubled.
quadriplicatus, *a, um*; four-folded.
quadrifurcatus, *a, um*; four-furrowed.
quadrivittatus, *a, um*; having four chaplets.
quincocostatus, *a, um*; five-ribbed.
quincuedactylus, *a, um*; five-fingered.

R

racemosus, *a, um*; full of bunches, bunchy.
racemus; a bunch or cluster of florets.
radîatus, *a, um*; radiating from a point; ray-like.
radicans; rooting; branching out like roots.
radiciformis, *is, e*; root-shaped; root-like.
radio-punctatus, *a, um*; marked with radiating or star-like punctures.
ramosus, *a, um*; branching; having many branches.
Ramsayii; after Professor Ramsay of the Geological Survey.
ramulosus, *a, um*; branchy; full of little branches; slightly branching.
Rankineâ; after Dr Rankine of Carlisle, in Lanarkshire.
raphiodon; needle-toothed; prickle-tooth.
raricostatus, *a, um*; having few rib-like processes.
rari-spinus, *a, um*; having few spines.
rari-stella; having few star-like pores.
rastellum; a little rake; rake-like.
rectus, *a, um*; straight; without bend.
recurvirostra; bent beak or jaw.
recurvus, *a, um*; bent back.
remiformis, *is, e*; oar-shaped.
reniformis, *is, e*; kidney-shaped.
repandus, *a, um*; repand; slightly waved at the margin.
replicatus, *a, um*; folded back upon itself.
resupinatus, *a, um*; upside down.
reticularis, *a, um*; netted; meshed like a net.
reticulatus, *a, um*; reticulate; like network.

RET — SCO

retrorsus, *a, um*; turned backwards; bent back.
retrusus, *a, um*; thrust back; hidden; concealed.
retusus, *a, um*; blunt.
reversus, *a, um*; reversed; turned or bent back.
revolutus, *a, um*; turned back; curled back.
rhaphiodon; club-tooth; shaped like a club.
rhombus; a rhomb or lozenge; lozenge-like.
rhomboides; like a lozenge; diamond-shaped.
Richardsoni; after Mr Richardson of London, geologist.
rigidulus, *a, um*; somewhat stiff; stiffish.
rigidus, *a, um*; rigid; stiff; not flexible.
rimosus, *a, um*; full of chinks.
ringens; gaping; having an open orifice.
Robertsoni; after Mr Robertson of Edinburgh, geologist.
rostralinus, *a, um*; having a little beak.
rostratus, *a, um*; beaked.
rostro-minor, *or, us*; minor-beaked; lesser-snouted.
rotatus, *a, um*; wheel-shaped; wheel-like.
Rothomagensis, *is, e*; from or belonging to Rouen.
rotifer, *a, um*; wheel-bearing.
rotulus, *a, um*; slightly rounded.
rotundatus, *a, um*; rotund; rounded.
rudis, *is, e*; not worked or fashioned; rude.
rugatus, *a, um*; wrinkled.
rugosus, *a, um*; full of wrinkles.
rugulosus, *a, um*; somewhat wrinkled; minutely wrinkled.
runcinatus, *a, um*; hook-backed.

S

sagittatus, *a, um*; arrow-shaped; barbed like an arrow.
sagittula; a little arrow; like a little arrow.
salmonæus, *a, um*; salmon-like; pertaining to the salmon.
sarcinulatus, *a, um*; having a wallet or pouch.
sauroplesiæus, *a, um*; most closely allied to the lizard family.
saxatilis, *is, e*; stony.
saxeus, *a, um*; stony; stony in texture.
scaber, *a, um*; rough; rough-surfaced.
scabræculus, *a, um*; rough.
scabriusculus, *a, um*; somewhat rough; roughish.
scalariiformis, *is, e*; ladder-shaped.
scarabæus; a beetle; beetle-shaped; beetle-like.
scaraboides; beetle-like; like the scarabæus.
scariosus, *a, um*; scarious; having a dry shrivelled appearance.
schisærus, *a, um*; split-tail; rent-tail.
scissus, *a, um*; split; marked by a line of division.
scobriculatus, *a, um*; pitted.
scopiformis, *is, e*; tufted; tuft-shaped.
Scotticus, *a, um*; Scottish; found in Scotland.

- Scouleri*; after Dr Scouler of Glasgow, naturalist.
scrofa; a sow; sow-like.
scrotiformis, *is, e*; pouch-shaped.
scutatus, *a, um*; shield-like; buckler-shaped.
scutelliformis, *is, e*; buckler-formed.
scutiformis, *is, e*; scute- or shield-shaped.
sectus, *a, um*; cut or cleft.
secundarius, *a, um*; secondary; second in order; inferior.
securiformis, *is, e*; hatchet-shaped.
Sedgwickii; after Professor Sedgwick of Cambridge, geologist.
selaginoides; selago-like; leafed like the plant *selago*.
Selwyni; after Mr Selwyn of the Geological Survey.
semifabelliformis, *is, e*; half fan-shaped.
semiglobus; half-globe; hemispherical.
seminiferus, *a, um*; seed-bearing; marked with small seed-like granules.
semiornatus, *a, um*; half-ornamented.
sempiternus, *a, um*; half-smooth.
semiplicatus, *a, um*; half-folded.
semiserratus, *a, um*; half-serrated.
semistriatus, *a, um*; half-striated.
semisulcatus, *a, um*; half-furrowed.
semistylus; half-taper.
semiverrucosus, *a, um*; half-warty.
senticosus, *a, um*; covered with prickles; prickly.
septatus, *a, um*; divided by septa or partitions.
septemplex, *a, um*; seven-folded.
septosus, *a, um*; full of septa or partitions.
serialis, *is, e*; in rows or series.
sericeus, *a, um*; silky.
serpentinus, *a, um*; serpentine; winding.
serpularius, *a, um*; serpula-like; worm-like.
serpulus, *a, um*; creeping; worm-formed.
serra; a saw; saw-like.
serratus, *a, um*; highly serrated; excessively serrated.
serratus, *a, um*; saw-edged; serrated.
serriferus, *a, um*; bearing serrations.
serrulatus, *a, um*; minutely serrated.
sertus, *a, um*; bound; joined together.
sigmoides, *a, um*; sigma-shaped; like the letter S.
siliquaria; pod-like.
Sillimani; after Professor Silliman, American geologist.
Siluriensis, *is, e*; belonging to the Silurian system.
similimus, *a, um*; most like; most closely allied to.
simplex; simple; undivided; not branching.
sinistrorsus, *a, um*; left-handed; turned to the left.
sinuatus, *a, um*; marked with depressions; wavy.
socialis, *is, e*; living in groups; social.
solarium; sun-dial; like the flattened univalve *solarium*.
solenoides; like the razor-shell, *solen*.
Sowerbyi; after Mr Sowerby of London, conchologist.

SPA — SUB

- spatulatus*, *a, um*; spatula-shaped; spatulate; blade-shaped.
speciosus, *a, um*; beautiful.
spectabilis, *is, e*; notable; worth seeing.
spelæus, *a, um*; belonging to a cave; cave-dwelling.
speluncarius, *a, um*; cavernous.
sphæricus, *a, um*; spherical; round-bodied.
sphæroidalis, *is, e*; spherical.
spicatus, *a, um*; spiked; in spikes like an ear of corn.
spiniger, *a, um*; spiny; bearing spines.
spinipes; spine-footed; having the feet armed with spines.
spinosus, *a, um*; spiny; covered with many spines.
spinulosus, *a, um*; full of little spines.
spiratus, *a, um*; having spires; spiral.
spirorbis; spiral-whorl (shell of an annelid).
squamatus, *a, um*; scaly; furnished with scales.
squamiger, *a, um*; carrying scales; faintly scaled.
squamosus, *a, um*; scaly; covered with scales.
stellaris, *is, e*; starred; rayed like a star.
stellatus, *a, um*; starred; covered with star-like dots.
Sternbergii; after Count Sternberg, fossil botanist.
stramineus, *a, um*; as if covered with straw.
striatellus, *a, um*; minutely striated; slightly striated.
striato-punctatus, *a, um*; spotted in striæ or parallel lines.
striatulus, *a, um*; somewhat striated.
striatus, *a, um*; striated; minutely fluted.
Stricklandii; after Mr Hugh Strickland, English geologist.
striolatus, *a, um*; very minutely striated.
stromboides; resembling the shell *strombos*.
Stutchburii; after Mr Stutchbury, geologist.
stylôphora; mark-bearing; impressed with a mark.
subangulatus, *a, um*; somewhat cornered.
subaratus, *a, um*; somewhat defaced (literally, ploughed up).
subarcuatus, *a, um*; slightly bow-shaped or bent.
subarmatus, *a, um*; somewhat armed.
subcarinatus, *a, um*; somewhat keeled; furnished with slight ridges; indistinctly ridged.
subconvexus, *a, um*; somewhat convex.
subcristatus, *a, um*; rather crested.
subdepressus, *a, um*; somewhat depressed.
subfimbriatus, *a, um*; slightly fimbriated.
subfusiformis, *is, e*; somewhat spindle-shaped.
subnodosus, *a, um*; somewhat knotted; marked with slight projections.
subnudus, *a, um*; somewhat naked.
subreticulatus, *a, um*; somewhat reticulated.
subrotundus, *a, um*; sub-rotund; somewhat round; roundish.
subserratus, *a, um*; slightly serrated.
subteres; somewhat tapering.
subtrigonus, *a, um*; somewhat three-cornered.
subturbidatus, *a, um*; somewhat top-shaped.
subulatus, *a, um*; awl-shaped; subulate.

SUB — TOL

subulidens; awl-toothed; having awl-shaped teeth.
succulens; succulent; soft and not woody.
succulosus, *a*, *um*; very soft and succulent.
Suffolciensis, *is*, *e*; of or belonging to Suffolk.
sulcatus, *a*, *um*; furrowed.
sulcifer, *a*, *um*; bearing furrows; marked with furrows.
sulcostomus, *a*, *um*; having a mouth deeply furrowed.
superbus, *a*, *um*; superb; magnificent.
Sussexiensis, *is*, *e*; found in or belonging to Sussex.
syloëstris, *is*, *e*; belonging to the woods; inhabiting the woods.

T

tabulatus, *a*, *um*; boarded; planked.
tæniatus, *a*, *um*; tape-worm-shaped.
tarandus; the reindeer; reindeer-like.
taxinus, *a*, *um*; belonging to the yew-tree; yew-like.
taxus; the badger; badger-like.
tendillus, *a*, *um*; very tender; delicate.
Tennanti; after Professor Tennant of London, mineralogist.
tenuicaulis, *is*, *e*; slender-stemmed or stalked.
tenuiceps; slender head; slender-headed.
tenuidens; slender tooth; slender-toothed.
tenuifasciatus, *a*, *um*; slender-banded.
tenuifolius, *a*, *um*; slender-leaved.
tenuilamellosus, *a*, *um*; having slender lamellæ, or thin plates.
tenuirostris, *is*, *e*; slender-beaked; slender-snouted.
tenuis, *is*, *e*; slight; slender.
tenuisæptus, *a*, *um*; slightly divided; slender-partitioned.
tenuispinus, *a*, *um*; slender-spined.
tenuistriatus, *a*, *um*; finely striated; slightly striated.
tërebra; a borer or auger.
tërebratus, *a*, *um*; bored; perforated.
tëres; rubbed to a point; tapering.
teretisculus, *a*, *um*; slightly tapering; somewhat taper.
tessellatus, *a*, *um*; tessellated, like the squares of a dice-board.
tesseracontadactylus, *a*, *um*; forty-fingered.
testacella; little shell.
testudiniformis, *is*, *e*; turtle- or tortoise-shaped.
tëtragonus, *a*, *um*; four-cornered.
tëtrasticha; in four rows.
textilis, *is*, *e*; woven; like a web.
thujoides; like the *thuja* or *arbor-vitæ*, one of the conifers.
thymifolius, *a*, *um*; thyme-leaved; leaves like the thyme.
thyrospëndylus; having perforated vertebrae.
tichorhînus, *a*, *um*; partition-wall-nosed; applied to a fossil rhinoceros, in allusion to the structure of the nose- or snout- bones.
tintinnâbulum; a little bell; like a little bell.
tolâpicus, *a*, *um*; pestle-like; from the Isle of Sheppey.

TOM — UMB

tomentosus, *a, um*; thickly covered with short stiff hairs.
Tommasinii; in honour of Tommasini, the podestà of Trieste.
torquatus, *a, um*; twisted round.
tortuosus, *a, um*; tortuous; twisted.
Trailli; after Dr Traill of Edinburgh, naturalist.
transversus, *a, um*; transverse; cross-wise.
trapeziformis, *is, e*; four-sided; trapezium-like.
triacontadactylus, *a, um*; thirty-fingered.
triangularis, *is, e*; triangular-shaped; three-cornered.
trichotomus, *a, um*; divided into three.
tridactylites; three-fingered; three-fingered-like.
trifidus, *a, um*; cleft or divided into three.
trifoliatus, *a, um*; three-leaved.
trifurcatus, *a, um*; three-forked.
trigonalis, *is, e*; triangular; three-cornered.
trigonicus; triangular-headed.
trigonocanthus, *a, um*; three-cornered spine.
trigonocerus, *a, um*; three-cornered or triangular horn.
trigonus; three-cornered-like.
trigonus, *a, um*; three-cornered.
trilobatus, *a, um*; three-lobed; in three main parts.
trinervis, *is, e*; three-nerved; having three veins.
trinodus, *a, um*; three-knotted; consisting of three knots or knobs.
trochiformis, *is, e*; trochiform; like the *trochus* or wheel-shell.
trochlealis, *is, e*; pulley-shaped.
trochoides; like the *trochus* or wheel-shell.
tropæus, *a, um*; twisted or turned round.
truncatus, *a, um*; truncated; cut short.
tubæformis, *is, e*; trumpet-shaped.
tuberculatus, *a, um*; covered with tubercles; warty.
tuberosus, *a, um*; tuberoses; composed of tuber-like parts.
tubipora; organ-piped; tubular-pored.
tubularis, *is, e*; hollow like a pipe; tubular.
tubulatus, *a, um*; furnished with pipe-like pores or passages.
tubulosus, *a, um*; abounding in tubes; made up of tubes.
tumidulus, *a, um*; slightly swollen.
tumidus, *a, um*; tumid; swollen out.
Tunstallensis, *is, e*; after Tunstall Hill in Durham.
turbinatus, *a, um*; top-shaped.
turbinellus, *a, um*; little top-shaped.
turbinoides; shaped like a top.
turgidus, *a, um*; turgid; swollen out.
turris; a tower; tower-shaped.

U

umbella; an umbrella; umbrella-like.
umbilicatus, *a, um*; navel-shaped; umbilicated.
umbonatus, *a, um*; bossed; protuberant.
umbracliformis, *is, e*; umbrella-shaped.

umbrōsus, *a, um*; shadowed.
uncātus, *a, um*; hooked; hook-shaped.
uncifolius, *a, um*; hook-leaved; hook-like leaf.
uncinātus, *a, um*; hooked; furnished with hooks.
undans; waving; in waving lines.
undātus, *a, um*; wavy.
undorū, *a, um*; wavy; full of heights and hollows.
undulātus, *a, um*; undulating; in wavy lines.
unguiculātus, *a, um*; claw-like; furnished with claw-like processes.
unguiformis, *is, e*; claw-shaped.
unicarinātus, *a, um*; having one ridge or keel.
unicolor; one-coloured; of uniform colour.
unilinedātus, *a, um*; one-lined; marked with one line.
uniplicātus, *a, um*; once folded.
urceolātus, *a, um*; pitcher-shaped; pitcher-like.
Urie; after the Rev. Dr Ure of Rutherglen.
uropogillus, *a, um*; tail-leaved; tapering like a tail.
utricularis, *is, e*; bag-like.

V

vāgans; wandering.
vagina; a sheath.
Valdensis, *is, e*; belonging to the Wealden formation.
vātū, *a, um*; strong; stoutly built.
Vanuxemi; after Vanuxem, American geologist.
variābilis, *is, e*; variable; not always the same.
varians; variable; changing.
varicosus, *a, um*; varicose; having swollen veins.
variocostātus, *a, um*; differently ribbed; having ribs of different sizes.
variolāris, *is, e*; spotted with pimples.
vasculāris, *is, e*; vascular; having little vessels.
Vectiensis, *is, e*; of or belonging to the Isle of Wight.
vellamen; a covering or veil.
velicans; sail-like; with sail-like fins.
velox; swift; fitted for rapid motion.
velutinus, *a, um*; velvety; soft.
venosus, *a, um*; full of veins.
ventricosus, *a, um*; bulging out; bellying.
ventroplānus, *a, um*; smooth-bellied.
venustus, *a, um*; fair; elegant.
vermiculāris, *is, e*; worm-shaped; vermicular.
vermiculoides; worm-like; vermicular.
Verneuilianus, *a, um*; after M. Verneuil, geologist.
verrucosus, *a, um*; warty; covered with wart-like projections.
vertebrālīs, *is, e*; vertebra-like.
verticillātus, *a, um*; whorled; verticillate.
verus, *a, um*; true; genuine.
vesiculāris, *is, e*; vesicular; bladder-like.
vesiculōsus, *a, um*; full of vesicles; bladdery.

VET — ZIN

vetustus, a, um; ancient.
villösus, a, um; villous; covered with soft short hairs.
vimineus, a, um; osier-like; withy.
violaceus, a, um; approaching to a violet hue.
virgatus, a, um; twig-shaped; rod-like.
virgula; a rod or twig.
virgulatus, a, um; rod-shaped; like a bundle of rods.
vitreus, a, um; glassy; like glass in lustre.
vittatus, a, um; banded or bound with a fillet.
vomer; a ploughshare; ploughshare-like.
vulgaris, is, e; vulgar; very common.
vulgatus, a, um; common.
vulpiceps; fox-headed; having a head like a fox.
vulturinus, is, e; vulture-like; belonging to the vultures.

W

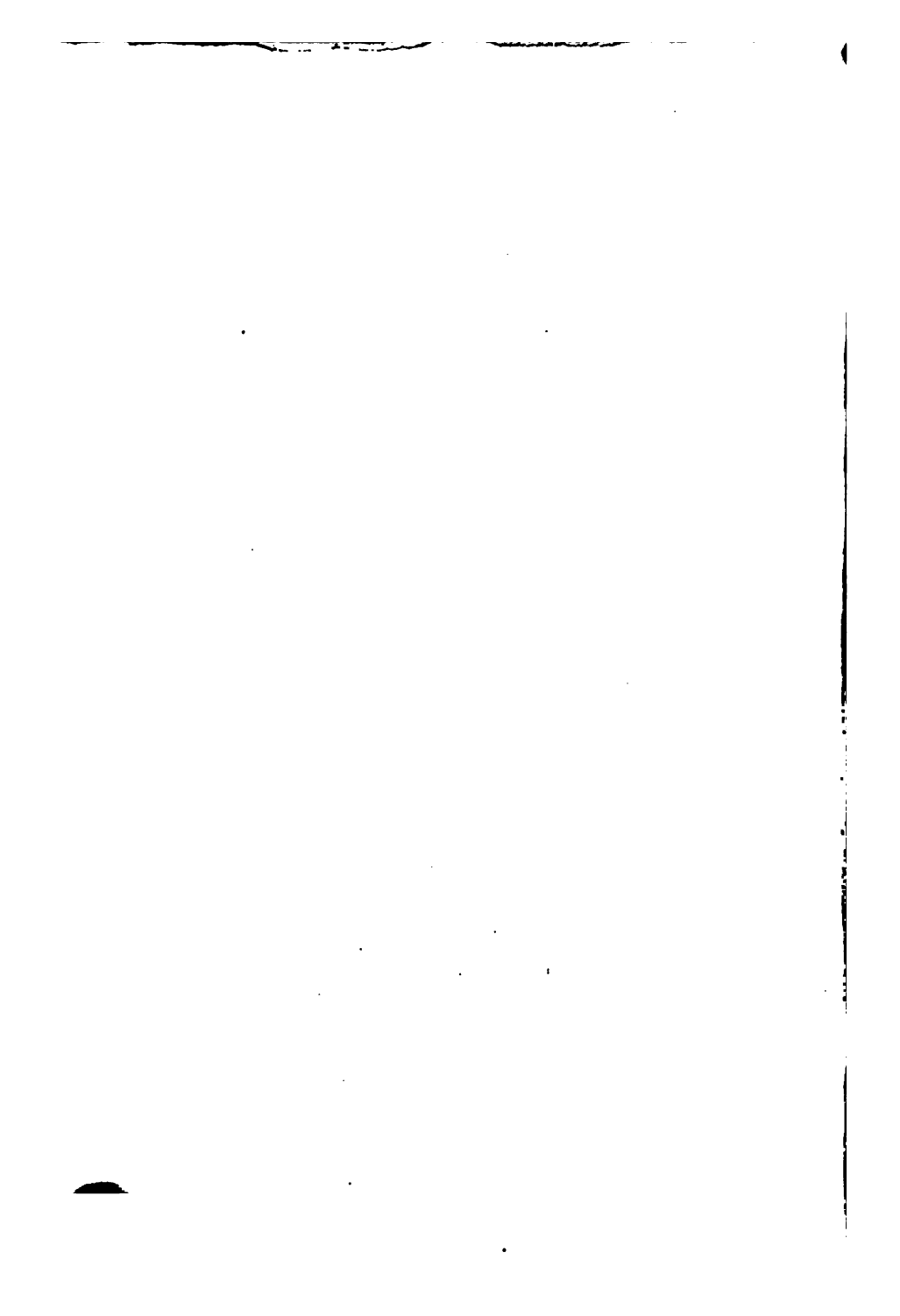
Waterhousei; after Mr Waterhouse of London, zoologist.
Wetherelli; after Mr Wetherell, botanist and geologist.
Whitbyensis, is, e; from Whitby on the Lias in Yorkshire.
Williamsonis; after Dr Williamson of Scarborough, botanist.
Withami; after Dr Witham of Edinburgh, palæontologist.
Woodii; after Mr Searles Wood of London, geologist.
Woodwardii; after Mr Woodward, conchologist.
Wrightii; after Dr T. Wright of Cheltenham, palæontologist.
Wymani; after Professor Wyman of Canada.

X

xiphodon; sword-tooth; having a sword-like tooth.

Z

zamioides; zamia-like; resembling the plant *zamia*.
zebra; the zebra; striped or banded like the zebra.
zig-zag, zig-zag; slanting in straight lines from side to side.
zingiberiformis, is, e; ginger-root-shaped.



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